SPRINGS

THE RACHEL CARSON CENTER REVIEW

Issue #6 | 2024

October

HANDLING HEAT: A CONVERSATION WITH ELSPETH OPPERMANN

Elspeth Oppermann and Daniel Dumas

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The Rachel Carson Center Review

6 • 2024

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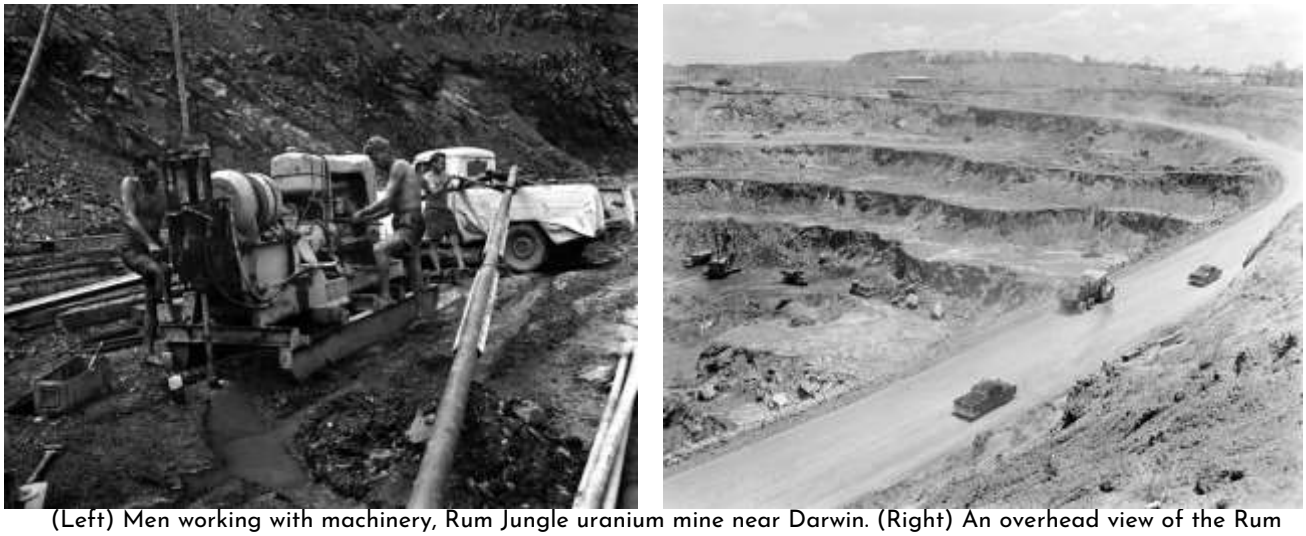
Critical geographer Elspeth Oppermann worked on the UK–ESRC-funded Cool Infrastructures project, which brought her to the Rachel Carson Center (RCC) as a senior research fellow in 2020. Elspeth currently works on a transdisciplinary pilot project on heat and undernutrition, based at the International Institute for Environment and Development (IIED), and funded by the Wellcome Trust, the Volkswagen Foundation, and NovoNordisk. Daniel Dumas (RCC) recently completed his doctoral dissertation, which critically assesses representations of Indigenous peoples and geographies in Canada. While Elspeth's work relates primarily to adapting to heat exposure, she has a cocker spaniel who can't stand the heat and would rather run in the snow in Germany than the sand in Singapore. Though Daniel does not currently have a dog, you can find him channelling his inner Golden Retriever when jumping into the Isar River on any hot day in Munich. Here, Elspeth and Daniel discuss what it means to work in and on heat in the age of global heating.

Daniel Dumas: Elspeth, it seems like you have got a real passion for heat-related research. You've worked on the Cool Infrastructures project and considered how people in their everyday lives experience and respond to chronic heat exposure, and now, you are working on a transdisciplinary pilot project on how undernutrition and heat stress relate to one another. What kindled your interest in heat-related topics?

Elspeth Oppermann: Most of my work has been at the intersection of heat stress as a hazard and the impacts that has on working people. My interest in both stems very much from my childhood, growing up in Darwin, Australia. The Top End of Australia is known for being hot and humid and

DOI: 10.5282/rcc-springs-12460

therefore basically a horrible place to work—at least if your work is outdoors. My interest in occupational health—and my passion to investigate the everyday lives of workers—stems from my father. As someone who finished school at 15, he didn't have a choice but to work in so-called low-skill labor-intensive roles—in railways, forestry, and mining. Specifically, he had worked in a copper and uranium mine known as Rum Jungle during its final years of operation. We lived on the same street as a man he had worked with, and both he and my father died of lung cancer within six months of each other, when I was twelve. In my mind, there was no doubt this was related to their shared work at the mine. I will never know for certain if it was the cause of their deaths, but copper mines are notorious for high rates of lung cancer amongst their workforce. As such, occupational health is a very personal matter for me.



(Left) Men working with machinery, Rum Jungle uranium mine near Darwin. (Right) An overhead view of the Rum Jungle open-pit mine.

Because of the environmental destruction that mining activities cause, it is often overlooked that those working at mine sites are themselves often the most exposed to these same risks. They also do the work they do for a host of mundane reasons—the necessity of employment or of providing for a family—and not out of some evil desire to violate the earth. I wanted to explore how, in their everyday lives, workers navigate the risks of such dangerous employment, and heat is one of those risks.

DD: I'm sorry to hear about the loss of your Dad, and I thank you for sharing that. It is clear that this is a deeply personal topic. How did you then start working on adaptation and heat stress, from a research perspective?

EO: I'd conducted my PhD on adaptation to climate change in the UK but moved back to Darwin for my postdoc in a political climate—at both the state and federal level—that was very hostile to discussions of climate change under then-prime minister Tony Abbott. As such, work on climate change had to be conducted "under the radar," as it were—so I focused instead on current climatic conditions. This turned out to be very generative as outdoor workers were already dealing with climate-change impacts in the form of intensification of chronic heat exposure (which is experienced seasonally or year-round, in places like northern Australia and Singapore, respectively).

DD: Why do you think work on adaptation to heat stress is such an important topic, especially in regard to climate change?

EO: Heat is already one of the biggest killers. In Australia, heat is known to kill more people than all other environmental hazards combined. Globally, however, deaths connected to heat have been poorly reported, for various technical reasons, and, as such, its impact has often been assumed to

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be less than what it is. That's changing—there were reported to be 50,000 deaths from heat in Europe last year, and with the frequency and intensity of heat waves increasing globally (and faster in Europe than anywhere else), this issue is forcing its way onto political agendas, with the UN Secretary General recently. calling for urgent and substantial global action. Globally, the number of people affected by chronic heat exposure could be as much as 5 billion by 2050.

DD: On a more individual level, how does heat impact people in everyday life? And how does this differ across the world?

EO: So, we see very different impacts depending on whether you're somewhere that experiences moderate conditions with only occasional heat waves (such as temperate regions, like Europe), or whether you're somewhere that experiences hot conditions chronically. In places where occasional heat waves are the concern, the risk is that people are not physiologically or behaviorally adapted to the problem. I've experienced this living and working in Munich—both my apartment and my office (before I started at the RCC) had no air-conditioning, no fans, and no shade over the windows; both were in the city center and baked in the urban heat-island effect. Although prevailing weather conditions only reached 30 degrees Celsius, I felt much more vulnerable than I had on a mine site in Australia at 42 degrees Celsius, where air-conditioning for recovery overnight was available and iced water was ubiquitous.

> *What heat-health practitioners hope to see, are quite radical shifts in daily practices so that people avoid the heat, avoid exertion, and the resulting health risks.*

In addition to the absence of material sources of resilience, when people encounter heat waves as a novel condition, they are not physiologically acclimatized or behaviorally adapted. As such, they might expose themselves for too long, or work too hard, with the result that their body has too high a "thermal load," such that they risk developing heat-related illness, perhaps heat exhaustion or even heat stroke, or otherwise suffer a cardiovascular or respiratory failure. In these situations, what heat-health practitioners actually hope to see, are quite radical shifts in daily practices so that people avoid the heat, avoid exertion, and these resulting health risks. In places where heat is chronic, people are better acclimatized but still put up with low-level chronic impacts such as frequent headaches or irritability, and always with the risk that even a small change in heat-adapted work processes will increase exposure or exertion and be enough to push them into more severe heat-related illness.

DD: Nearly all of your work is focused on chronic heat exposure, tropical heat, and humid heat. Can you tell us about what this is and why it's important?

EO: When I began writing on this topic about a decade ago, most of the focus in the academic and policy literature in the climate adaptation and disaster risk management space was on heat waves in temperate zones. As such, the literature and policy responses were missing a huge swathe of how, where, and when heat is dangerous—the tropics were largely overlooked, even though they have some of the world's biggest exposed populations (think of India, Southeast Asia, and Nigeria, for example). I was collaborating with Dr. Matt Brearley, a thermal physiologist, who had been working in northern Australia for a long time and who—as far as I'm aware—coined the term "chronic heat exposure"—that is, seasonal or year-round exposure to heat stress.

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This image from Costa Rica demonstrates how the common construction process of building upward floor by floor means workers responsible for the preparation for concreting (rebar and form work) are always exposed to the sun. Photo by Josue Isai Ramos Figueroa, 2018. Unsplash. Public domain.

DD: Speaking of collaboration, you've done quite a lot of work with physiologists and occupational health professionals. What has this been like?

EO: It's been fun! It's opened doors to field sites and provided access I would never have had on my own, such as mine or construction sites or factories, and working with partners I never would have anticipated, such as medical doctors from the Vietnamese military. The disciplinary difference has been very generative… It's given me an insight into how physics and physiology frame the problem and, in doing so, opened up new ways of thinking about everyday practices of heat management that take on a more-than-human, elemental, and phenomenological flavor. For example, using thermal imaging cameras, and core body temperature monitoring pills (tiny thermometers encased in capsules that participants swallow), I was able to trace how heat flows from machinery to bodies and the intimate way microenvironments and people's behavior in them shapes heat exposure. Being involved in government-funded projects and part of networks like GHHIN (the Global Heat Health Information Network), has also given me a front-row seat to observe how differently heat-health is problematized by varying disciplines and sectors. Public-health officials, largely informed by epidemiology, for example, identify "hot" conditions based on numbers of hospital visits or deaths, which is very different from meteorologists, who operate based on historical (environmentally monitored) norms.

> *My worry is that as global heating ramps up, we'll see the militarization of the borders of survivable zones and the further weaponization of heat exposure to protect them.*

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DD: You mentioned working with the Vietnamese military, and there have been some elements of thinking about the military that have popped up from time to time in your work. Can you tell us about these?

EO: Firstly, thermal physiology has its origins as a military discipline, so engaging with the former implicitly brings with it histories of militarization, occupation, and the use of soldiers' bodies. At Charles Darwin University in Australia, I led a scoping study for the Australian Department of Defence on how heat stress under climate change might affect preparedness and operations. This was an interesting experience as we were reporting on implications without by any means having access to the necessary information about what defense capabilities there were and what was planned for the region—so this was an exercise in deduction and informed speculation that really reinforced for me the importance of being "on the inside" to do really effective work.

Nevertheless, the report was effective—I did hear the feedback that it was considered the best value for money project that unit had funded that year, and climate change is increasingly discussed within the military, in Australia and globally. For us as researchers, in the hostile political climate at the time, we wanted to make the most of the opportunity to have anyone with a direct line to the federal government taking the threat of climate change seriously. Finally, militarization has always been a facet of territorial expansion and the securitization of borders—heat has been historically a very powerful factor in this—we can take European settler colonial struggles to cope with heat in the tropics as one example. My worry is that as climate change, or global heating, ramps up, we'll see the militarization of the borders of survivable zones and the further weaponization of heat exposure to protect them or manage behavior elsewhere. Nicole Starosielsky and others have done brilliant work demonstrating this, drawing on examples from the US–Mexico border to Afghanistan.

DD: You've now touched upon various collaborations across multiple different projects, so I must ask which research methods you employ across these projects and if they differ—for instance, is it primarily conducting interviews and doing government-related research?

EO: Although I've done desk-based research, the majority of my work has been using sensory ethnography combined with a social-practices approach that in turn draws on the shift to new materialisms to pull in interdisciplinary insights from thermal physiology and environmental monitoring. I do this to pay attention to the way thermal energy flows between bodies and environments and how its doing so is modulated by practices. You can see this in the way workers learn to time their performance of certain tasks on a worksite, making use of the movement of the sun and where shade is available, for example. It is these everyday "mundane" and "lay" knowledges that play a huge role in keeping workers safe.

> *Workers actively show us the places that are hot, the tools that are heavy, the surfaces that radiate heat, the vats from which steam spews forth.*

As such, the methods themselves have involved combining ethnographic interviews with physiological monitoring to get workers to explain their experience of a workday and examining that recursively in relation to their monitored data (heart rate, core temperature, step count, for example). This helps us to understand what really drives heat stress. The simple answer might be, "It's a hot day," but the combined physiological and ethnographic answer might instead be, "The team is one man down due to illness and receiving a lot of verbal pressure from the foreman to complete the repair, so they're working longer and harder than they should in the heat." The sensory ethnography part (drawing on Sarah Pink) is my favorite aspect of this—heat is something that you have to *feel*. Finding ways to get people to show or describe sensation is complicated, so we make sure we do interviews in situ and compliment these with video tours of workplaces and living quarters—workers actively "show" us around these spaces, show us the places that are hot, the tools

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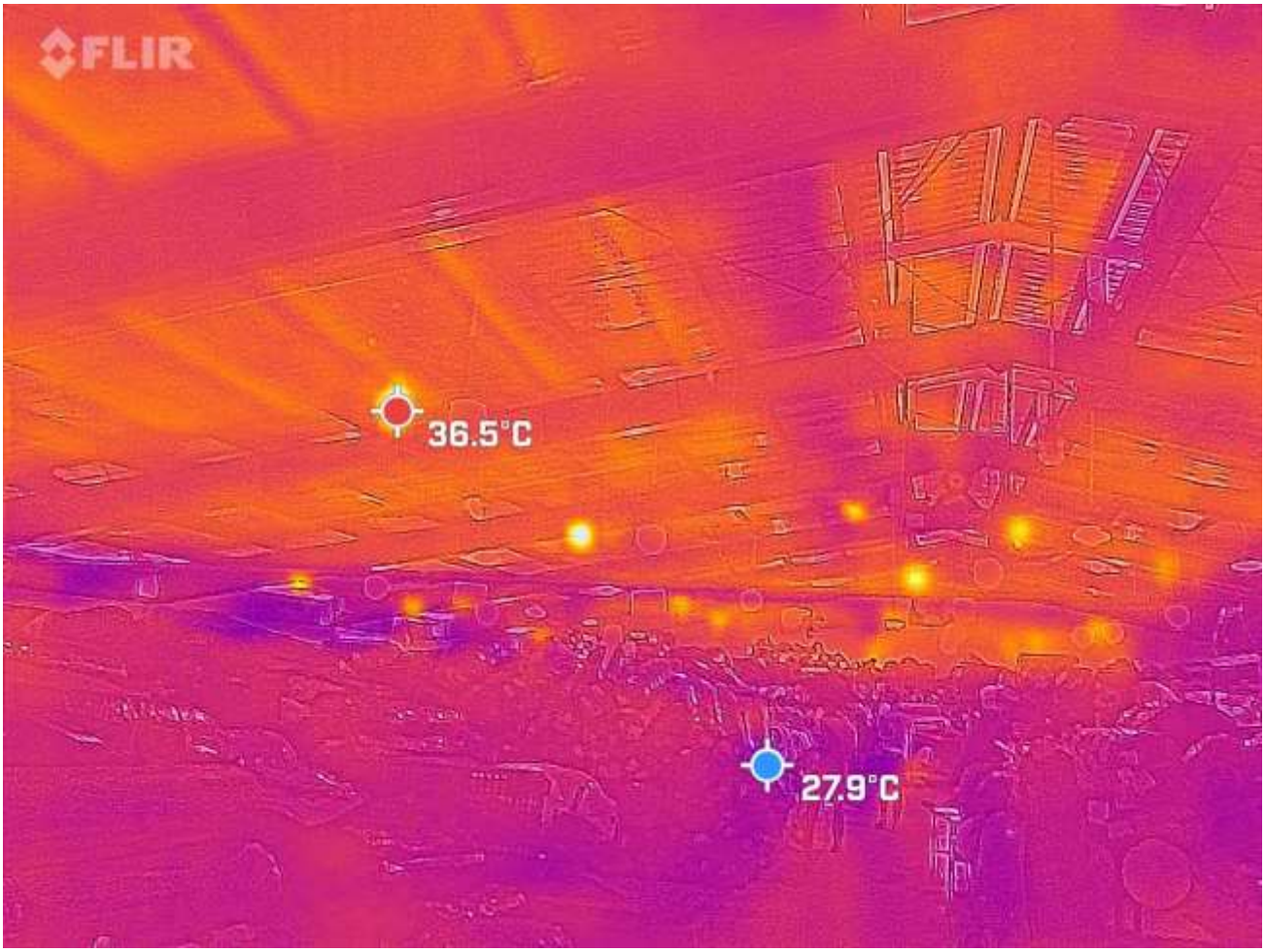
that are heavy, the surfaces that radiate heat, the vats from which steam spews forth. In doing so, as researchers we are not just seeing but also touching surfaces and feeling spaces so we can also sense what our respondents do—and start to catalogue all the energetic exchanges they are describing.



Thermal image of factory roof from a field site in Vietnam, radiating heat at 36.5 degrees Celsius. The coolest surface in the factory is 27.9 degrees Celsius. Many factories across Southeast Asia use uninsulated roofing material, so heat from the sun is reradiated into the interior.

DD: Any new and exciting methodologies you're itching to try?

EO: Through my time as a researcher at Charles Darwin University, I worked in proximity to researchers on Indigenous Knowledges in Australia (Ground Up), who really drummed into me the need to pay attention to moments of disconcertment when engaging with people operating out of ontological, epistemic commitments different from my own. In the recent HeatSafe project in Singapore, it became very apparent that the Bangladeshi and Tamil workers we were speaking to understood what caused heat-related illness and how to treat it somewhat differently from the Western account of heat health adopted by our research team. Some of these principles could be explained with reference to other systems of medical knowledge such as Ayurveda. However, in the course of the project, the workers' understandings were somewhat sidelined as "interesting but slightly irrelevant."

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Yet the truth is they are far from irrelevant if these are the principles workers are using to treat heat illness day to day. Furthermore, by ignoring them, we are enacting a kind of ontological violence. This became very apparent when I found myself in the position of recommending ingestion of cold water when, for many of the workers, this was seen as potentially unhealthy. If workers were to follow our advice, this runs the risk of being perceived as thermal violence (à la Nicole Starosielsky), even though it was clearly intended as an act of thermal care. This situation was, of course, ethically fraught but also intellectually fascinating. It got me thinking about just how widespread such disjunctures might be and how we might do a better job of working in good faith with different knowledges in devising occupational health policy.

Person making sandalwood paste. Ayurveda offers multiple strategies to manage heat, one of which is applying sandalwood paste to the body to cool the skin. Photo by Harsha K R. Flickr. CC BY-SA 2.0.

DD: This is fascinating, given that it moves away from a solely Western account of heat health. How are traditional forms of medicine being integrated into your current work?

EO: These "alternative" knowledges about heat perhaps shape the behavior of most of the global population outside of Western countries. If we think about the enormous populations of South Asia and China that follow, to some degree at least, what might broadly be grouped as Ayurvedic and Traditional Chinese medicine (TCM), there is huge potential not only for misinterpretation of Western-derived public-health messaging but for such messaging to be perceived as disingenuous, false, or even potentially dangerous. As such, together with a group of researchers from South Asia, we're working on a project proposal at the moment that will bring together different kinds of knowledge authorities (Ayurvedic and other traditional medicines, TCM, and Islamic knowledge authorities, together with thermal physiologists and public-health officials) to examine how various ontologies of heat health differ and align, to build a better understanding of the issues at stake, and to see what potential there might be for codeveloping—in particular places—shared public-health messaging that is commonly acceptable to the knowledge communities there.

DD: On a broader note, what do you think a warming planet will entail? Are goals such as that of the Paris Agreement to keep the rise of global surface temperatures to well below 2 degrees Celsius even attainable?

EO: I have to hope that they are attainable. We absolutely must strive to keep warming well below that limit if we can, and even if we miss our goal, every fraction of a degree of warming we avoid saves us countless losses of life and unnecessary suffering. We are already locked into an amount of warming that is pushing the limits of what our health-care systems can cope with. We had 50,000 deaths from heat in Europe alone, just last year, with about 1.5 degrees Celsius of warming. This is not acceptable, but it's conceivable that as long as further warming is prevented, we might be able

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to improve our systems enough to cope. However, warming beyond 2 degrees Celsius would be catastrophic. We could be looking at a tripling of deaths by the end of the century. Not only would health-care systems be impacted but so would productivity and GDP overall—and that's just from heat, let alone all the other impacts of climate change.

> *We are already locked into an amount of warming that is pushing the limits of what our health-care systems can cope with.*

DD: Is there room for hope then?

EO: Yes, there absolutely is. I was privileged to act as an expert for the European Commission (EC) for their occupational-health summit last year. Heat has now been placed as a key aspect of the framework approach on climate-change impacts across the EU. It was very encouraging to see the beginnings of a deep level of intellectual engagement and careful political negotiation taking place between, for example, the European Trade Union Confederation (ETUC), informed by the European Trade Union Institute (ETUI), BusinessEurope, and the EC regarding how heat should be addressed.

DD: Are there any practical policy initiatives that you've seen come out of these engagements?

EO: The projects I've been involved in have been largely aimed at effecting policy change at least at the company level, if not beyond. In Australia, we worked with McArthur River Mine to implement changes at the site level—including ensuring crushed ice was permanently available across the site. In Singapore, for Project HeatSafe, a series of interventions (cold water ingestion, regular breaks, and climate-appropriate clothing) were trialed at the company level, and an educational video on managing heat was developed in multiple languages (Bengali, Tamil, Chinese, and English), which is now being rolled out across the city-state for new employees working in construction. As an expert for the European Commission on climate change and occupational health for their 2023 political summit on occupational safety and health, I was able to provide evidence to support discussions regarding the importance of climate-change impacts and particularly extreme heat for workers across the EU. I know this evidence was drawn on during the discussions, which led to a political statement reinforcing climate change and heat as key action areas for the next few years. Some of that work also informed conversations that have been taking place between the EC, ETUC/ETUI, and BusinessEurope as they've negotiated whether, and if so how, to develop a legally enforceable threshold temperature for work cessation across the EU.

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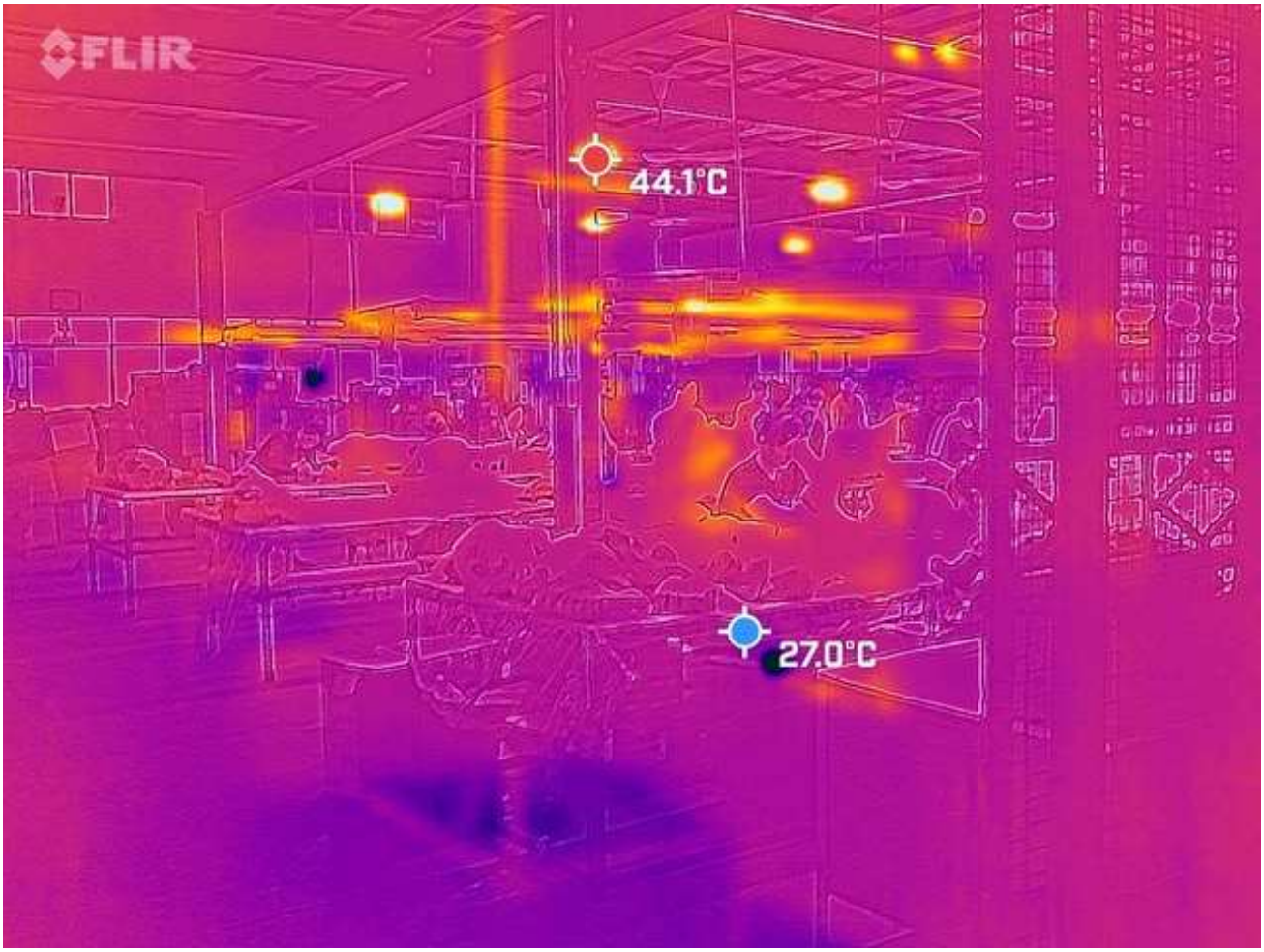

Thermal image of factory floor, with temperatures ranging from 44.1 to 27 degrees Celsius. The patches of yellow and red demonstrate heat generated by lighting and machinery—and highlighting the variety of experiences; workers at some stations are more exposed to heat than others. © Teledyne FLIR / Elspeth Oppermann. All rights reserved.

DD: Are there big areas that you think are missing in heat research?

EO: There have been some major shifts in heat research over the last few years. Some of the "hot" topics recently have been how heat stress combines with air pollution to produce deadly conditions, and the other is the mission to identify whether chronic exposure to heat, or chronic dehydration, contribute to CKD—chronic kidney disease of unknown origin, which is responsible for tens of thousands of deaths every year.

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This worker rolling up his sleeves and with his helmet sitting too high on his head demonstrates what may be a trade-off between risks—immediate thermal comfort being privileged over longer-term risks of UV-protection and physical impacts/trauma. © 2023 JSB Co. on Unsplash+. All rights reserved.

There are two areas that I think are missing and may be just as important. The first of these is examining how malnutrition and heat stress interact. It's a fact that in many parts of the world facing chronic exposure to extreme heat, populations are also widely malnourished—this includes being undernourished where food sources are limited (think of displaced populations from conflict and environmental stress in parts of Africa, Asia, and the Middle East). Crucially, as climate change progresses, extreme heat is likely to trigger heat waves as well as droughts, resulting in people encountering extreme heat with reduced access to food. The Wellcome Trust-funded pilot project I'm part of first examines the state of the evidence on the relationship between undernutrition and heat stress, and second looks at how this problem plays out in the specific context of internally displaced people's (IDP) mobility. We will be working with experts and NGOs in Pakistan and Nigeria to develop a conceptual framework for how mobility, heat stress, and undernutrition relate.

The second issue that I think has gone widely unrecognized is the assumption that there is "one way" to understand heat health. This is deeply problematic. First of all, meteorologists, physiologists, and epidemiologists don't always agree on what conditions are "hot" and why they matter. This is in part because their objects of concern are different. They might be the environmental system, the human body, or the health system—all have different but related vulnerabilities to heat. The difference between these disciplines, however, can be somewhat bridged by their common foundation in Western scientific thought, and particularly thermodynamics. However, there are everyday knowledges as well as alternative medical knowledges of heat beyond those of Western science that we must take seriously, as I've touched on already.

DD: So then, I'm curious to ask, thinking about everyday knowledges, what does your work show in terms of best strategies to survive on a warming planet?

> *There are everyday knowledges as well as alternative medical knowledges of heat beyond those of Western science that we must take seriously.*

EO: We need to aim for decent quality of life (including safety at work). In the labor-intensive workplace (from factories to construction sites), there is so much that can be done to improve the lives of workers, a lot of it relatively simple and mostly accessible measures: Allowing new workers time to acclimatize, self-pacing the rate of work, scheduling heavy work for cooler times of day (or night, in some cases), allowing frequent rest-breaks, ensuring sufficient hydration, allowing access to ice slurries for ingestion and/or active cooling in airconditioned refuges. A lot of workers know many of these things already but do not feel able to ask for or implement them, so creating organizational cultures backed by workers' rights, where they are free to speak out helps greatly. Ensuring people have the chance to cool down and recover when they get home—and indeed on their way to and from work—are also major issues. Tackling how heat plays out across different domains (home and work, public and private) requires collaboration across multiple sectors and

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branches of government. However, on the global scale, none of these measures will be enough if we don't get emissions under control and aim for less than 2 degrees of warming, so we have to keep that goal in focus too.

DD: Thank you very much for sharing, Elspeth, and for tackling this important topic in your research and practices!

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Elspeth Oppermann is a critical geographer specializing in everyday adaptation to extreme heat in the context of climate change. Elspeth has collaborated widely across sectors and disciplines, and has developed a novel approach, which combines ethnography with thermal physiology to better understand socio-material and energetic relations between bodies and their environment. She recently completed two three-year international, multidisciplinary projects: Cool Infrastructures, on cooling in informal settlements, and Project Heatsafe, helping workers and their families adapt to heat in Singapore and Vietnam. She has been affiliated with the RCC since 2020.

Daniel Dumas is a PhD candidate at the RCC and the Department of Geography at Ludwig-Maximilians-Universität Munich. He holds an MA in geography from the University of Ottawa. Daniel's research has focused on past and present representations of Indigeneity and the environment within the Canadian context. His most recent contributions are published in the *International Journal of Canadian Studies*, *Political Geography*, and the *Zeitschrift für Kanada-Studien*.

Cite this article

Oppermann, Elspeth, and Daniel Dumas. "Handling Heat: A Conversation with Elspeth Oppermann." *Springs: The Rachel Carson Center Review*, no. 6 (October 2024). https://doi.org/10.5282/rcc-springs-12460.

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ISSN 2751-9317

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