

December 29, 2023

Dr. Monica Contestabile,  
Chief Editor, *Nature Sustainability*

Dear Dr. Contestabile:

Please find enclosed our revised manuscript entitled “Trends and disparities of hazardous heat exposure among incarcerated people in the United States” (NATSUSTAIN-23093333-T). We have revised the text according to the comments and suggestions of the Editors and Reviewers, in the original submission, as outlined in our responses. Please find our responses to the Editors, as requested, below:

**Dear Dr Parks,**

**Your manuscript entitled "Trends and disparities of hazardous heat exposure among incarcerated people in the United States" has now been seen by 3 referees, whose comments are attached. You will see from their comments below that while they find your work of interest, some important points are raised.**

**While Reviewers 1 and 3 were favorable to your manuscript, Reviewer 2 still had some remaining concerns regarding the interpretation of the results, among others. The rest of the referees' reports are clear and the remaining points should be straightforward to address. We are very interested in the possibility of publishing your study in Nature Sustainability, but would like to consider your response to these concerns in the form of a revised manuscript before we make a final decision on publication.**

We thank the Editors and Reviewers for their thoughtful and constructive suggestions. We have revised the manuscript in response to the Editors' and Reviewers' comments, as detailed below.

We have tried our utmost to respond to the suggestions below, particularly from Reviewer 2. We are mindful, however, that this is a Brief Communication with a strict word limit of 1,700 words, and we have therefore attempted to balance the two priorities.

All page/line/reference numbers refer to the tracked revised manuscript.

**We are committed to providing a fair and constructive peer-review process. Do not hesitate to contact us if there are specific requests from the reviewers that you believe are technically impossible or unlikely to yield a meaningful outcome.**

**If you have not done so already please begin to revise your manuscript so that it conforms to our Brief Communication format instructions at <http://www.nature.com/natsustain/info/final-submission/>**

**Nature Sustainability Brief Communications have a word limit of 1,500 words (including abstract, references and figure legends, and contains no headings) with 2 small display items (figures or tables). We have some flexibility, and can allow a revised manuscript at 1,700 words, but please consider this a firm upper limit.**

We have maintained a total word limit of 1700 words) with 2 figures in the revised manuscript.

**After the main text, a Brief Communications carries a Methods section of about 500 words and does not count towards the main text length. For additional details, please use a Supplementary Information file.**

The Methods section is 289 words in the revised manuscript.

**Nature Sustainability titles should give a sense of the main new findings of a manuscript, and should not contain punctuation. Please keep in mind that we strongly discourage active verbs in titles, and that they should ideally fit within 90 characters each (including spaces).**

The proposal title of the paper, ‘Trends and disparities of hazardous heat exposure among incarcerated people in the United States’, contains no active verbs in titles, and is 96 characters including spaces.

**To improve the accessibility of your paper to readers from other research areas, please pay particular attention to the wording of the paper’s opening bold paragraph, which serves both as an introduction and as a brief, non-technical summary in no more than 70 words. If, however, you require one or two extra sentences to explain your work clearly, please include them even if the paragraph is over-length as a result. The opening paragraph should be unreferenced. Because scientists from other sub-disciplines will be interested in your results and their implications, it is important to explain essential but specialised terms concisely. We suggest you show your summary paragraph to colleagues in other fields to uncover any problematic concepts.**

We have edited the paper’s opening bold paragraph. We have incorporated the Editors’ instructions of a word limit of 70 words with one or two extra sentences, currently at a word count of 92 words, as below in the revised manuscript (P. 2, Lines 19-26):

*~~Incarcerated~~The ~2 million incarcerated people in the US are at high risk for United States face growing heat-related illness and death. However, a comprehensive assessment of heat conditions at US carceral facilities is required. Here, we health risks. We evaluated recent exposure trends to potentially hazardous heat —defined as number of days annually the maximum wet bulb globe temperature (WBGT<sub>max</sub>) exceeded 28°C— during 1982–2020 at for 4,078 continental US carceral facilities holding ~2 million incarcerated people. On average, during 2016–2020. We found that state-run carceral facilities in Texas and Florida accounted for 52% of total exposure, despite holding 12% of all incarcerated people. Further, the number of hot days per year increased during 1982–2020 for 1,739 carceral facilities experienced 41.25 million person days of exposure annually, with state prisons contributing 61%, and encountered 5.5 more potentially hazardous heat days annually compared to the remainder of the US population. An estimated 915,627 people (45% of total) were incarcerated in 1,739 facilities with an increasing number of days per*

~~year WBGT<sub>max</sub> exceeded 28°C; southern facilities experienced the most rapid changes. Our findings, primarily located in the Southern US. We highlight the ~~urgent need~~urgency for enhanced infrastructure, health system interventions, and ~~reform in the~~treatment of incarcerated people, especially ~~as~~under climate change ~~intensifies hazardous heat exposure.~~~~

Please include a separate “Data availability” subsection at the end of your Methods. This section should inform our readers about the availability of the data used to support the conclusions of your study. This information includes references to source data published as supplementary items (Excel sheet) alongside the paper, accession codes to public repositories, unique identifiers such as URLs to data repository entries, or dataset DOIs, and any other statement about data availability. At a minimum, you should include the following statement: “The data that support the findings of this study are available from the corresponding author upon request”, mentioning any restrictions on availability. If DOIs are provided, we also strongly encourage including these in the Reference list (authors, title, publisher (repository name), identifier, year). For more guidance on how to write this section please see: <http://www.nature.com/authors/policies/data/data-availability-statements-data-citations.pdf>

We have done this, as below in the revised manuscript (P. 12, Lines 556-562):

#### **Data availability**

Daily 4-km PRISM data ~~from~~during 1982–~~to~~–2020 and HIFLD data are freely available at <https://prism.oregonstate.edu/recent/> and <https://hifld-geoplatform.opendata.arcgis.com>, respectively. National Center for Health Statistics (NCHS) bridged-race dataset (Vintage 2020) is available ~~from~~during 1990–~~to~~–2020 [https://www.cdc.gov/nchs/nvss/bridged\\_race.htm](https://www.cdc.gov/nchs/nvss/bridged_race.htm) and from the US Census Bureau before 1990 <https://www.census.gov/data/tables/time-series/demo/popest/1980s-county.html>.

If your paper is accepted for publication, we will edit your display items electronically so they conform to our house style and will reproduce clearly in print. If necessary, we will re-size figures to fit single or double column width. If your figures contain several parts, the parts should form a neat rectangle when assembled. Choosing the right electronic format at this stage will speed up the processing of your paper and give the best possible results in print. We would like the figures to be supplied as vector files - EPS, PDF, AI or postscript (PS) file formats (not raster or bitmap files), preferably generated with vector-graphics software (Adobe Illustrator for example). Please try to ensure that all figures are non-flattened and fully editable. All images should be at least 300 dpi resolution (when figures are scaled to approximately the size that they are to be printed at) and in RGB colour format. Please do not submit Jpeg or flattened TIFF files. Please see also 'Guidelines for Electronic Submission of Figures' at the end of this letter for further detail.

We have provided figures as separate pdf files.

Figure legends must provide a brief description of the figure and the symbols used, within 350 words, including definitions of any error bars employed in the figures.

We provide two figure legends for, both fewer than 350 words in the revised manuscript (PP. 14-15, Lines 596-609):

**Figure 1.** Mean annual exposure during 2016–2020 to potentially hazardous heat in carceral facilities within the continental United States ( $N=4,078$ ), measured by: (a) the number of person-days  $WBGT_{max}$  exceeded  $28^{\circ}\text{C}$  for incarcerated people by state and carceral facility type; and (b) the number of days  $WBGT_{max}$  exceeded  $28^{\circ}\text{C}$  for each carceral facility.

**Figure 2.** (a) Population-weighted difference between the annual number of days  $WBGT_{max}$  exceeded  $28^{\circ}\text{C}$  at the location of carceral facilities versus all other locations in the continental United States during 1982–2020, overall and stratified by state, ordered by average population-weighted difference, (b) the total change in the number of number of days  $WBGT_{max}$  exceeded  $28^{\circ}\text{C}$  per year for each carceral facility in the continental United States during 1982–2020, and (c) the total change in disparity in number of number of days  $WBGT_{max}$  exceeded  $28^{\circ}\text{C}$  per year for each carceral facility in the continental United States, compared with the rest of the state the carceral facility is located, during 1982–2020.

**Please limit the number of references to no more than 20, and then include any additional references for the Methods in this list as well. Article titles are omitted from the reference list. Any citations in the Supplemental Information will need inclusion in a separate SI reference list.**

There are 20 references in the revised manuscript.

**Please include a statement before the acknowledgements naming the author to whom correspondence and requests for materials should be addressed.**

We have done this in the revised manuscript (P. 12, Lines 569-571):

### **Correspondence**

*Correspondence should be addressed to Robbie M. Parks ([robbie.parks@columbia.edu](mailto:robbie.parks@columbia.edu)) and Cascade Tuholske ([cascade.tuholske1@montana.edu](mailto:cascade.tuholske1@montana.edu))*

Finally, we require authors to include a statement of their individual contributions to the paper -- such as experimental work, project planning, data analysis, etc. -- immediately after the acknowledgements. The statement should be short, and refer to authors by their initials. For details please see the Authorship section of our joint Editorial policies at [http://www.nature.com/authors/editorial\\_policies/authorship.html](http://www.nature.com/authors/editorial_policies/authorship.html)

We have done this in the revised manuscript (P. 13, Lines 589-592):

### ***Author contributions***

*C.T. and R.M.P. designed research; C.T., V.D.L., and R.M.P. performed research; C.T. and R.M.P. contributed analytic tools; C.T., V.D.L., Y.A., C.R., and R.M.P analyzed data; and C.T., V.D.L., R.S., A.E.N. and R.M.P wrote the paper with assistance from Y.A. and C.R.*

**When revising your paper:**

**\* include a point-by-point response to any editorial suggestions and to our referees. Please include your response to the editorial suggestions in your cover letter, and please upload your response to the referees as a separate document.**

We have done this below.

**\* ensure it complies with our format requirements for Letters as set out in our guide to authors at [www.nature.com/natsustain/info/gta/](http://www.nature.com/natsustain/info/gta/)**

We have done this.

**\* state in a cover note the length of the text, methods and legends; the number of references; number and estimated final size of figures and tables**

We have done this.

**Please ensure that all correspondence is marked with your Nature Sustainability reference number in the subject line.**

We have done this.

**We hope to receive your revised paper within four weeks. If you cannot send it within this time, please let us know.**

We have submitted our revised manuscript within four weeks of receipt of the reviews.

**Nature Sustainability is committed to improving transparency in authorship. As part of our efforts in this direction, we are now requesting that all authors identified as ‘corresponding author’ on published papers create and link their Open Researcher and Contributor Identifier (ORCID) with their account on the Manuscript Tracking System (MTS), prior to acceptance. This applies to primary research papers only. ORCID helps the scientific community achieve unambiguous attribution of all scholarly contributions. You can create and link your ORCID from the home page of the MTS by clicking on ‘Modify my Springer Nature account’. For more information please visit [www.springernature.com/orcid](http://www.springernature.com/orcid).**

**We look forward to hearing from you soon.**

The main text, including abstract and figure legends, is 1700 words. The abstract is 92 words. The legends for Figures 1 and 2 are 52 and 109 words, respectively. The methods section is 289 words. There are 20 references for the main text. The submission contains two figures, with additional information in the Supplementary Information. We have tried our utmost to respond to the suggestions from editors and reviewers. We are mindful, however, that this is a Brief Communication with a strict word limit of 1,700 words, and we have therefore attempted to balance the two priorities.

Unbearable and dangerous temperatures were common throughout the United States during the summer of 2023, with over 100 million people exposed to hazardous heat. Among the 2 million people currently incarcerated in the United States, concerning reports surfaced of heat-related illness and death over the last several summers. This is hardly surprising – incarcerated people in the United States are at high risk for heat-related morbidity and mortality in large part because they are physically confined, socially isolated, and have high rates of chronic mental and physical illnesses. Unlike most of the population in the United States, many incarcerated people are living without air conditioning.

While a nascent body of research has begun to explore how dangerous heat is impacting incarcerated people, this has largely been through case studies. Researchers and policymakers are yet to address the critical knowledge gap of understanding exposure to dangerous heat at carceral facilities across the country over multiple decades. As the effect of climate change accelerates in the United States, identifying where incarcerated people are exposed to dangerous heat is imperative to advancing environmental justice for one of the most marginalized groups in the country.

In the accompanying manuscript, titled “*Trends and disparities of dangerous humid heat exposure among incarcerated people in the United States*”, we fill this critical knowledge gap. We map daily maximum wet bulb global temperatures to 4,078 federal, state, and local carceral facility across the US to measure the trends in the number of dangerous humid heat days per year during 1982 – 2020. We (1) characterize dangerous humid heat at each carceral facility location and by facility type and state; (2) measure how exposure to dangerous humid heat at carceral facility locations compares with the rest of the population nationally and by state; and (3) calculate how the trends over of dangerous humid heat at carceral facilities has changed over time.

Our results reveal new and pressing insights about the disparities incarcerated people in the United States face when contending with dangerous humid heat. We find:

- During 2016 – 2020, on average annually, there were 41.25 million person-days of exposure at US carceral facilities, with the greatest contribution from state prisons (61%);
- There was a consistent disparity during 1982 - 2020, with carceral facilities exposed to an average of 5.5 more dangerous humid heat days than the rest of the US annually;
- An estimated 915,627 people (45% of total) are incarcerated in 1,739 facilities that experienced an annual increase in the number of dangerous humid heat days per year during 1982 – 2020; and
- Southern US facilities exhibited the most rapid warming, though many of these states do not mandate access to air conditioning for incarcerated people.

By identifying where incarcerated people are exposed to dangerous heat conditions, our work highlights how incarcerated people in the United States are systematically exposed to greater levels of dangerous humid heat than the rest of the United States population, with the greatest exposure and rates of increase concentrated in state-run institutions. We expect our work can aid federal, state, and local decisionmakers in efforts to mandate safe temperature ranges, enhance social and physical infrastructure, and implement health system interventions to mitigate the effect of dangerous heat on this marginalized group. To this end, all data and code supporting this analysis will be made publicly available upon publication, including the entire historical daily maximum wet bulb globe temperature record during 1982 – 2020 we construct for each carceral facility in the United States.

Because of the pressing and novel nature of our findings, we are resubmitting this revised manuscript for publication as a Brief Communication to *Nature Sustainability*. None of this material has been published or is under consideration elsewhere.

On behalf of our co-authors, we thank you for your time and consideration.

Sincerely,



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Asst. Professor of Human-Environment Geography  
Dept. of Earth Sciences  
Montana State University



Robbie M. Parks, PhD (he/his)  
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