

**From:** Elena Mihaly <emihaly@clf.org>  
**Sent:** Friday, May 10, 2024 11:50 AM  
**To:** Moore, Julie  
**Subject:** RE: S.259

**EXTERNAL SENDER: Do not open attachments or click on links unless you recognize and trust the sender.**

Hi Julie,

Thanks for your engagement on this. See below where I've pasted the email that Professor Mankin sent to Chairs Lelond and Sheldon in response to your testimony where you articulated concerns about the state of the science. Our coalition looks forward to working with you and the Treasurer's office to implement a scientifically sound and defensible approach to the tasks set forth in statute if the bill becomes law.

Best,  
Elena

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**From:** Justin S. Mankin <[Justin.S.Mankin@dartmouth.edu](mailto:Justin.S.Mankin@dartmouth.edu)>  
**Sent:** Thursday, April 25, 2024 8:39 PM  
**To:** Elena Mihaly <emihaly@clf.org>;  
**Subject:** Fwd: S.259

FYI

Begin forwarded message:

**From:** Justin Mankin <[justin.s.mankin@dartmouth.edu](mailto:justin.s.mankin@dartmouth.edu)>  
**Subject:** S.259

**Date:** April 25, 2024 at 8:38:41 PM EDT

**To:** [mlalonde@leg.state.vt.us](mailto:mlalonde@leg.state.vt.us), [asheldon@leg.state.vt.us](mailto:asheldon@leg.state.vt.us)

Dear Representatives LaLonde and Sheldon,

I'm Justin Mankin, a climate scientist at Dartmouth. I provided testimony in committees in the Senate and House for S.259.

Having watched Secretary Moore's testimony in your committee yesterday, I wanted to comment on her assessment of the state of emitter-based attribution science. Her testimony, which was informed by an hour-long conversation the two of us had, sowed doubt on whether attribution science was ready to be applied to the Vermont context in the way S.259 seeks. She suggested that the science was too immature, or insufficiently peer reviewed.

I firmly disagree with her characterization of the science.

The science is mature, peer reviewed, and ready for application. It is true there are choices to be made and those choices matter for any tallying of damages, but those are policy choices, not scientific ones.

For example, the Secretary, discussed a NBER paper I shared with her (note that this paper from colleagues at Stanford and it is my understanding that it is undergoing peer review). She suggested that the "values" we "plug into the equations" to get damages are uncertain or unknown and that this is because of a lack of scientific knowledge. This is not correct. One's chosen discount rate and one's chosen social cost of carbon are *policy* questions not *scientific* ones. Agencies like hers and the Treasury need to make those determinations and then the calculations can be performed.

Certainly, the Secretary is correct that my own group's research has focused on an emitter-based attribution from extreme heat, and that may be less relevant to Vermonters who have endured costly floods. Yet it is not the application to extreme heat, but the methodological framework, that is peer reviewed. That means it can be applied to many contexts and scales given data availability.

The Secretary suggested that there was insufficient damage functions of flood or heavy precipitation. In fact, there is considerable damage analysis of extreme rain and flooding:

- Davenport et al. (2021) <https://www.pnas.org/doi/abs/10.1073/pnas.2017524118>
- Kotz et al. (2022) <https://www.nature.com/articles/s41586-021-04283-8>

Both of these peer reviewed damage function models could be ported into my group's peer reviewed framework and be used to assess damages at the scale of Vermont.

The idea that the Secretary would need a peer reviewed application of emitter based flood damage to Vermont to proceed is not correct. The flood or precipitation damage function(s) and the attribution framework are already peer reviewed. One simply needs to apply them to the Vermont context given the bill. Those are questions of implementation, not science.

I did suggest an alternative to a hazard-by-hazard approach like the one I work on, such as using the social cost of carbon or SCC. This approach has been used by Dr. Rick Heede, another expert witness, and also has a rational basis. Importantly, there will never be one approach to climate accounting—there are a number of defensible approaches—and so waiting for one, as the Secretary suggests, is not about waiting for the science to mature. Instead, it is about waiting for implementing agencies on whether and how to move forward.

In the meantime, climate damages accumulate apace: Kotz et al. (2024) <https://www.nature.com/articles/s41586-024-07219-0>

Please let me know if I can be a resource for your work.

Warm regards,

Justin

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Justin S. Mankin

[Associate Professor of Geography](#)

[PI, Climate Modeling & Impacts Group](#)

P: 603.646.3381

O: 371 Irving Building

E: [mankin@dartmouth.edu](mailto:mankin@dartmouth.edu)

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**From:** Moore, Julie

**Sent:** Friday, May 10, 2024 10:04 AM

**To:** Elena Mihaly

**Subject:** S.259

CAUTION: Email from outside CLF.

Thanks, again, for your call this morning. I look forward to seeing any feedback from others you are able to share.

Here is both a link to the social cost of carbon presentation from EPA, as well as a screenshot of the specific slide I referred to:

[The Social Cost of Carbon for Regulatory Impact Analyses \(vermont.gov\)](#)

# Scope of Climate Science, Impacts, and Damages Included in the Updated SC-GHG Estimates

| Impacts and Associated Damages   |  |
|--|--|
| <b>Human Health and Well-being</b>   | <b>Buildings, transportation, and infrastructure</b>   |
| Heat and cold related mortality  | Sea level rise   |
| Mortality/morbidity from extreme weather events (e.g., storms, wildfire, flooding), and sea level rise             | Intensity or frequency of coastal storms   |
| Mortality/morbidity from climate mediated changes in the formation of criteria air pollutants (e.g., ozone, PM2.5) | Extreme weather inland (e.g., storms, wildfire, flooding)  |
| Infectious diseases  | Environmental conditions (e.g., melting permafrost, air temperature and moisture)  |
| Other morbidity (e.g., malnutrition, allergies)  | <b>Food production</b>   |
| Displacement and migration   | Agriculture/Crop production  |
| <b>Labor</b>   | Animal and livestock health and productivity   |
| Labor supply (i.e., hours worked)  | Fisheries and aquaculture production   |
| Labor productivity (i.e., output per hour worked)  | <b>Forestry- Timber, pulp, and paper production</b>  |
| <b>Energy</b>  | <b>Tourism, recreation, aesthetics</b>   |
| Energy consumption (e.g., heating, cooling)  | Visitation, locations, opportunities (e.g., recreational fishing, skiing, scuba diving, scenic views)  |
| Energy production and provision (e.g., hydroelectric, thermal power generation)                                    | <b>Ecosystem services</b>  |
| <b>Water</b>   | Availability and quality of natural capital used in production of marketable goods   |
| Water consumption (residential, industrial, commercial)  | Biodiversity and wildlife habitat (e.g., aquatic environments, breeding grounds)   |
| Provision of safe drinking water   | Other provisioning and regulating services (e.g., water filtration, wildfire and flood mitigation, medicinal resources, pest control, pollination) |
| Water storage and distribution   | Cultural services  |
| <b>Land</b>  | <b>Crime (property, violent)</b>   |
| Coastal land loss from sea level rise  | <b>National Security</b>   |
| <b>Trade and logistics</b>   | Military base impacts  |
| Supply chain disruption (e.g., from extreme weather)   | Military mission impacts from international civil conflict   |
| Supply chain transitions (e.g., altering trade routes)   | International development, humanitarian assistance   |

Source: EPA (2023).



**Julia S. Moore, P.E.** | Secretary (she/her)  
 Vermont Agency of Natural Resources  
 1 National Life Dr, Davis 2 | Montpelier, VT 05620-3901  
 802-828-1294 office  
[julie.moore@vermont.gov](mailto:julie.moore@vermont.gov)

[anr.vermont.gov](http://anr.vermont.gov)

*The Agency of Natural Resources supports telework and there are times when I may be working from another location. I am generally available to connect by phone and email during business hours. I am also available to meet in-person upon request.*

Help raise money for Vermonters impacted by flood damage and show your Vermont pride with *Vermont Strong* and *Tough Too* license plates and socks. [Click here to purchase your Vermont Strong gear](#) or visit [DMV.Vermont.gov/VermontStrong23](http://DMV.Vermont.gov/VermontStrong23).

Impacted Vermonters can find resources and referrals by visiting [Vermont.Gov/Flood](http://Vermont.Gov/Flood).