Hazardous Waste Litigation and Mapping: A template for designing maps of climate change attribution

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Abstract:

Over the last three decades, cartographers have been pushed to create and design new mapping techniques for communicating climate change. However, these maps, especially those in the United States (US) media, still operate from a standpoint of convincing readers that climate change is happening, often focused on rudimentary climate science such as temperature (Fish 2020). At the same time, climate scientists have created increasingly complex methods for better understanding environmental changes due to climate change. These maps stand in contrast with maps which are used for a related environmental cause: hazardous waste management. In the US, the federal policy which concerns hazardous waste management has recently been adopted as a mechanism for climate change litigation because it provides an existing method for observing, ameliorating and attributing liability for environmental pollution (Lockman and Shumway 2024; Clark and Anton 2024). Similarly, we hypothesize that the maps produced for hazardous waste management may provide a template for actionable, policy-oriented design styles which contrast with that of climate change maps. This presentation outlines 1) how the governing of hazardous waste management in the US leads to the creation of maps which differ from other environmental mapping, and 2) how those differences can lead to better cartographic communication about the science of climate change.

In the US, there are a host of assumptions about hazardous waste which contrast with the ways which we traditionally conceptualize climate change and affect the design and rhetoric of maps made of each of these phenomena. The US's Comprehensive Environmental Response and Liability Act (CERCLA) governs the cleanup and cost recovery of sites of extreme hazardous waste pollution, known as Superfund Sites. CERCLA follows a "polluter pays" logic which chronologically prioritizes waste remediation over the later cost recovery from polluters. In hazardous waste attribution, the null-hypothesis is that humans have caused Superfund sites pollution, and the burden would be to prove that the site is not somehow contaminated. In contrast, attribution of environmental changes to climate change operates under the opposite assumption. Despite the fact that the IPCC recognizes that global warming is "unequivocal" and "very likely" due to human activities, the null-hypothesis is typically that humans are not responsible for extreme events which may be linked to climate change (Trenberth 2011). Cartographically, this means that maps of hazardous waste tend to be more straightforward in nature, mimicking Ian Muehlenhaus' (2012) authoritative mapping style. Climate change cartography, on the other hand, is tasked with both emotionally communicating the severity of climate change while also maintaining a trustworthy posture and communicating uncertainty (Fish 2020; De Sherbinin et al. 2019).

The differences in how we approach hazardous waste versus climate change have to do with how we conceptualize the problem, how we communicate the problem, and who we hold accountable. The perception that climate change is a globally homogenous warming pattern caused by well-mixed gases contributed by society means attribution studies are largely focused on allocating responsibility to humanity. Comparatively, the perception that hazardous waste sites are discrete locations of pollution allows for the mapping and naming of responsible parties. This is not to imply that hazardous waste mitigation is easy to attribute. Rather, the "polluter pays" logic of CERCLA and the concrete and measurable impacts of hazardous waste result in maps which focus on the perpetrators (the polluters) and the victims (the surrounding communities). Climate change maps, by contrast, focus on the secondary impacts of pollution such as temperature change, weather events, and extreme heat. While potentially helpful for planning climate adaptation measures, the prevalence of these displays in policy maps effectively anonymizes both the polluter and the affected communities, absolving any parties of guilt and withholding restitution for those impacted.

This presentation focuses on an exploratory analysis of hazardous waste in the US to see how the underlying assumptions differ from maps of climate change. In maps such as the EPA's maps of contaminated locations and HazMatMapper (Nost et al. 2017), polluters are directly named. Additionally, the hazardous waste material is often supplemented by

actionable links to policy-related documents or relevant context from the cartographer. Based on our preliminary research, these hazardous waste maps are grounded in the present impacts of pollution, contain simpler interfaces as per Vincent *et al.*'s (2019) recommendations, and are more concretely tied to actionable policy-based remediation. Although there is broad consensus by scientists on the existence of anthropogenic climate change, the state of mapping climate change attribution lags significantly behind that of hazardous waste pollution. By examining how the logic of hazardous waste management get translated into mapping hazardous waste, we can start to understand how to better communicate complicated environmental disasters such as climate change.

References

Clark, Lesley, and Adam Anton. 2024. "A Superfund for Climate? These States Are Pushing for It." *E&E News by POLITICO*, March 6, 2024. https://www.eenews.net/articles/a-superfund-for-climate-these-states-are-pushing-for-it/.

De Sherbinin, Alex, Anamaria Bukvic, Guillaume Rohat, Melanie Gall, Brent McCusker, Benjamin Preston, Alex Apotsos, et al. 2019. "Climate Vulnerability Mapping: A Systematic Review and Future Prospects." *WIREs Climate Change* 10 (5): e600. https://doi.org/10.1002/wcc.600.

Fish, Carolyn S. 2020. "Cartographic Content Analysis of Compelling Climate Change Communication." *Cartography and Geographic Information Science* 47 (6): 492–507. https://doi.org/10.1080/15230406.2020.1774421.

Ivanković, Damir, Erica Barbazza, Véronique Bos, Óscar Brito Fernandes, Kendall Jamieson Gilmore, Tessa Jansen, Pinar Kara, et al. 2021. "Features Constituting Actionable COVID-19 Dashboards: Descriptive Assessment and Expert Appraisal of 158 Public Web-Based COVID-19 Dashboards." *Journal of Medical Internet Research* 23 (2): e25682. https://doi.org/10.2196/25682.

Lockman, Martin, and Emma Shumway. 2024. "State 'Climate Superfund' Bills: What You Need to Know." Climate Law Blog. March 14, 2024. https://blogs.law.columbia.edu/climatechange/2024/03/14/state-climate-superfund-bills-what-you-need-to-know/.

Muehlenhaus, Ian. 2012. "If Looks Could Kill: The Impact of Different Rhetorical Styles on Persuasive Geocommunication." *The Cartographic Journal* 49 (4): 361–75. https://doi.org/10.1179/1743277412Y.0000000032.

Nost, Eric, Heather Rosenfeld, Kristen Vincent, Sarah A. Moore, and Robert E. Roth. 2017. "HazMatMapper: An Online and Interactive Geographic Visualization Tool for Exploring Transnational Flows of Hazardous Waste and Environmental Justice." *Journal of Maps* 13 (1): 14–23. https://doi.org/10.1080/17445647.2017.1282384.

Trenberth, Kevin E. 2011. "Attribution of Climate Variations and Trends to Human Influences and Natural Variability." *WIREs Climate Change* 2 (6): 925–30. https://doi.org/10.1002/wcc.142.

Vincent, Kristen, Robert E Roth, Sarah A Moore, Qunying Huang, Nick Lally, Carl M Sack, Eric Nost, and Heather Rosenfeld. 2019. "Improving Spatial Decision Making Using Interactive Maps: An Empirical Study on Interface Complexity and Decision Complexity in the North American Hazardous Waste Trade." *Environment and Planning B: Urban Analytics and City Science* 46 (9): 1706–23. https://doi.org/10.1177/2399808318764122.