Birgit Schneider | Lynda Walsh

The politics of zoom

Problems with downscaling climate visualizations

Suggested citation referring to the original publication:
Geo: Geography and Environment 6 (2019) 1, Art. e00070
DOI http://dx.doi.org/10.1002/geo2.70
ISSN (online) 2054-4049

Postprint archived at the Institutional Repository of the Potsdam University in:
Postprints der Universität Potsdam
Philosophische Reihe ; 159
ISSN 1866-8380
http://nbn-resolving.de/urn:nbn:de:kobv:517-opus4-424819
DOI https://doi.org/10.25932/publishup-42481

Accepted: 1 December 2018

DOI: 10.1002/geo2.70

RESEARCH ARTICLE

The politics of zoom: Problems with downscaling climate visualizations

Birgit Schneider[1] | **Lynda Walsh**[2]

[1]Universität Potsdam, Potsdam, Germany

[2]University of Nevada, Reno, NV, USA

Correspondence
Birgit Schneider
Email: birgit.schneider@uni-potsdam.de

Funding information
Ludwig-Maximilians-Universität München, Grant/Award Number: Rachel Carson Center Short-Term Fellowship

Following the mandate in the Paris Agreement for signatories to provide "climate services" to their constituents, "downscaled" climate visualizations are proliferating. But the process of downscaling climate visualizations does not neutralize the political problems with their synoptic global sources—namely, their failure to empower communities to take action and their replication of neoliberal paradigms of globalization. In this study we examine these problems as they apply to interactive climate-visualization platforms, which allow their users to localize global climate information to support local political action. By scrutinizing the political implications of the "zoom" tool from the perspective of media studies and rhetoric, we add to perspectives of cultural cartography on the issue of scaling from our fields. Namely, we break down the cinematic trope of "zooming" to reveal how it imports the political problems of synopticism to the level of individual communities. As a potential antidote to the politics of zoom, we recommend a downscaling strategy of connectivity, which associates rather than reduces situated views of climate to global ones.

KEYWORDS
climate change, climate services, climate visualization, connectivity, downscaling, spherical, synopticism, zoom

1 | INTRODUCTION

Global data maps and visualizations are essential means for producing and presenting all relevant climate change knowledge. Since Paris 2015, they play an increasing role for local climate action and climate politics. This is because with the new emphasis on "Climate Services" after Paris 2015, there is a push to "downscale" global climate knowledge to the local level to empower communities and to "support[s] decision-making" (United Nations 2015, p. 10). Climate services shift climate change research from problems to solutions, from climate system science to climate consultancy services – and with these shifts come all sorts of private organizations and government institutions that strategically facilitate local attempts to implement climate change policies.[1] These enterprises are structuring a completely new market centered around climate services.

Many of the new products on this market break down climate science for practice to "bring the data to the people" and "regionally downscale" global climate visualizations and impact analyses (see WMO; European Framework Horizon 2020). Downscaling – a set of operations to transform global into local scale – is taking place on different levels. On the one hand, there are many technical methods for "downscaling" global climate models, the most common of which is the distribution of Regional Climate Models (RCMs) derived from Global Circulation Models (GCMs; Mahony & Hulme, 2016). Another method – which is in the focus of this paper – is to deliver all relevant ecological and climate data via mapping and visualization methods on digital platforms. Powerful interactive cartographic monitoring tools have been developed to reach user communities in government, academia, and the non-profit sector, primarily, but also stakeholders in climate-sensitive communities along coasts and in tropical zones. These tools are created with the goal of relating *global* knowledge to *local* situations and thereby empowering communities to take climate action.

However, interactive visual downscaling turns out not to be as automatic and transparent as the slider bar or "zoom tool" featured in many of these applications leads us to believe: rather, "zooming" is a rhetorical trope – both verbal and visual – that manufactures logical and political continuity from what is in reality a diverse and incommensurable set of views of climate. Critical geographers and ecologists have published critiques of the politics of scale and interscalarity in global visualization (see for example Castree et al., 2007; Cosgrove, 2008; Crampton, 2001; Herod & Wright, 2002; Moore, 2008; Smith, 1992; Taylor, 1982). However, the phenomenon of zooming in interactive downscaled climate visualizations has not yet been addressed by these scholars, and it needs to be, as its dynamism presents problems that go beyond static interscalar or global/local representations of climate.

Leon Gurevitch, a media-studies scholar, has studied the Google Earth platform on which many interactive climate visualizations operate. He has coined the term "Google Warming" to denote the combination of global synopticism (seeing the world in a glance or from a "god's eye view") and virtualization (the rendering of physical landforms, mineral resources, and vegetation as features inside a computer model) that encourages users to view climate as something that can be changed inside a computer. While he does not directly attribute to "Google Warming" the advent of geoengineering schemes to cool the climate, he does argue for the inseparability of these two phenomena (Gurevitch, 2014, pp. 89–90).

Gurevitch does not analyze the dynamics of the zoom tool as part of "Google Warming." So, in this paper, we extend his work to consider the specific politics of zoom. To do so, we combine approaches from media studies and rhetoric. As Gurevitch has demonstrated, media studies can historicize and analyze the cinematic dynamics of zooming in interactive downscaled climate visualizations. But to understand the trope of "zoom" itself, we need rhetoric, the disciplinary home of the trope. While many disciplines certainly deal with tropes, rhetoric is unique in understanding them as essentially political, i.e., as strategies that rely on community norms to reconfigure those norms and induce action (Baake, 2003, pp. 72–73; Perelman & Olbrechts-Tyteca, 1969, pp. 153–171). Together, rhetoric and media studies enable us to explicate the process of zooming as a figurative and political one, rather than the transparent and literal process it is presented as in the vast majority of the environmental-studies literature.

After a brief review of the existing critical literature on global synopticism and global–local interscalarity, we add to this literature with an analysis of zooming in several examples of interactive climate visualizations, via which we demonstrate its political problematics. We conclude by suggesting ways to reconfigure the trope of zooming to produce more just and equitable downscaled climate visualizations.

2 | GLOBAL SYNOPTICISM

Climate as an object of research and action is structured globally: measurements in particular locations such as surface temperature change, concentration of carbon dioxide, and precipitation are aggregated into models that generate global patterns, trends, and projections. Global synoptic (meaning "seen together" or in overview) views of climate are now so ubiquitous that it is easy to forget that they were painstakingly assembled at a particular historical moment in order to serve particular epistemic and political purposes.

Global synopticism is rooted in early geography and data visualization (governmental accounting, table work), of which Alexander von Humboldt's climate "isotherm map" of the Northern Hemisphere (1817) is perhaps the most famous example (Schneider, 2012, 2018). Synopsis was valued as an epistemic ideal, the means by which Enlightenment scholars could transcend their physical limitations and observe the laws that governed life on Earth: *all-seeing* was prerequisite to *all-knowing*. Since the 18th century synopsis has promised to provide a deep understanding of superhuman-scale systems *at a glance* and made regularities in these systems *evident* (literally: "plainly visible"). Finally, synopsis promoted *efficiency* by combining multiple datasets in a single viewframe, as epitomized by William Playfair's trade-balance graphs, Joseph Priestley's historical charts (both 18th century), Joseph Minard's graph of Napoleon's disastrous Russian campaign (19th century) or Jacques Bertin's charts of visual variables (20th century).

It is hardly an exaggeration to say that "climate change" as a concept would not exist without synoptic (global) views of weather and, later, concentrations of carbon dioxide and ozone. The graphing of climate data onto world maps created climatography, the geographical arm of meteorology. Distributing geographical data across space enabled the definition of patterns and relations such as climatic zones and warming trends. Nevertheless, previous research by critical humanities scholars has demonstrated that synoptic mapping has also contributed to the formation of political inequalities.

These political dynamics are most clearly seen in maps of social issues. Multiple scholars have made compelling cases for the ways in which synopticism and hegemony support each other to normalize populations. Michel Foucault, for example, found in John Graunt's synoptic tables of mortality in 17th-century London the seeds of the notion of "population" and thus the "birth of biopolitics," in which rulers stopped governing individuals and started setting norms for group behavior. The synoptic shift led, in Foucault's view, to restrictive norms of gender, health, and sexuality that privileged white men without ever laying out an explicit moral case for this privilege: anything that was otherwise was simply disciplined out of power (Foucault, 2007, p. 103). Donna Haraway brought this critique specifically to maps by theorizing the ways in which the "god trick" of the synoptic empowers those who make the maps while disempowering viewers who have no authority or means to alter them (Haraway, 1997, p. 136). Michel de Certeau termed this kind of objectification a "strategy" of "panoptic practice" (Certeau, 1984). Critical scholars of technical graphics have also documented the disempowering effects on viewers of synoptic graphics such as global maps (Barton & Barton, 1993; Brasseur, 2003; Dragga & Voss, 2001; Kress & Van Leeuwen, 1996).

The totalizing, disabling effects of global synopticism are particularly apparent in synoptic climate visualizations. "Burning Worlds" and other global maps depict warming as so extreme and ubiquitous that they overwhelm the possibility of individual localized action (Schneider, 2016). Meanwhile, synoptic graphs of global warming, such as those authored by the United Nations Intergovernmental Panel on Climate Change (IPCC), seem dislocated from viewers' experience, thus failing to make them feel connected to and effective regarding the problem of climate change (Sheppard, 2012). Even more problematic, synoptic global maps of climate don't treat viewers equally. The equation of global climatic isotherms with cultural zones both suggested and supported racist theories in the 19th century (Hulme, 2008; Stehr & Von Storch, 1999). Today, global maps showing intense deforestation, carbon loss, and warming in tropical zones are used to limit resource use in developing countries while eliding the catastrophic damage caused by industrial development in Northern-temperate zones in the previous 200 years (Adger, 2006).

Empirical evidence supports these critical conclusions about the effects of climate synopticism. O'Neill and Nicholson-Cole (2009) found that synoptic graphs showing projections of rising temperature made (non-expert) viewers feel unable to do anything about climate change. Schneider and Nocke (2018) similarly found a negative correlation between "burning world" maps and viewers' reports of climate agency. Most studies concentrate on the impact of visuals on non-experts. Only recently have studies examined the role of climate visuals in policy communities (Lorenz et al., 2015; Morseletto, 2017), but these do not focus on the effects of synopticism.

Global synopticism thus remains an exigent problem for climate communicators, particularly as the crux of climate communication appears to have pivoted away from the scientific evidence for climate change and toward mitigation and adaptation strategies (Moser, 2016). In other words, the discourse has moved on from questions of knowledge to questions of action, but this shift brings its scalar problems with it: namely, the scale of visualizations of climate knowledge is incommensurate with the scale of political action. Climate is visualized on a global scale, yet there is no polity (community of governance) that can take climate action on a global scale. To be effective politically, climate knowledge needs to share the scale of polity.

The signers of the Paris Agreement recognized to some degree these problems: thus, the calls for downscaled visualizations in support of climate services. But do we really obtain a more empowering perspective by downscaling? Can we escape the political problems with the synoptic in this way? These questions haven't been answered yet, and a detailed look at the logic and rhetoric of downscaling is required to answer them. But before we dig into these problems from the perspective of media studies and rhetoric, first we must review existing discussions of global–local interscalarity.

3 | GLOBAL VERSUS LOCAL AND THE PROBLEMS OF INTERSCALARITY

As mentioned above, scholars of cultural geography have recognized since the 1980s that regimes of cartographic scale and the geometric practices designed to alter them were inseparably linked to politics. Prompted by the materialist argument that maps produce realities, critical and political cartography has presented in detail the political implementations of different scaling practices: for example, how a chosen scale is able to highlight or suppress qualities of the place depicted, how political struggles influence scalar practices, but also how the national scale is not automatic but must be actively produced. This literature points out how scale can be actively used to frame the interpretation of reality. The differences between "local" (smaller than Nation scale) and "global" (Earth scale), but also the distinctions among "regional," "national" and "world," are generated by cartographic discourses of scaling (Herod & Wright, 2002). Tracing this line of reasoning into climate-change discourse, geographers and environmental studies scholars have argued for the relevance of scale and the need to problematize it as a core concept in communicating climate change (Gupta et al., 2007; Mahony & Hulme, 2016; Wilbanks & Kates, 1999).

An alternative paradigm transcends the two-dimensional limitations of the global/local paradigm. Anthropologist Tim Ingold has suggested an environmental view of the problem (Ingold, 1993). He rethinks the geometrical opposition of global/local via a global/spherical paradigm (Figure 1). Ingold characterizes global views in familiar terms, as opaque, massive, objective, detached, distant, centripetal, confrontative, visual, total. Spherical views, in contrast, are transparent, soft, subjective, close, surrounding, centrifugal, acoustic, and experienced. All living beings, Ingold argues, experience climate and environment spherically due to the sensory limits of our situation on the earth. Spherical views of climate and environment are maintained in many traditional societies, whose climate knowledge is increasingly valued and promoted by scientists and humanities scholars (Mahony & Hulme, 2016; Morton et al., 2013; Rudiak-Gould, 2013). Moreover, spherical views are essential to climate action, as the sphere delineates a rhetorical space in which political action can literally change the world (Goodnight, 2012).

In spite of his valorization of spherical views, Ingold should not be read as advocating that they supplant global views; rather, he envisions a "dialectic of engagement and detachment" (Ingold, 1993, p. 45) between the paradigms. After all, atmospheric scientists only recognized "climate change" as a phenomenon after they had employed synoptic techniques. Surely it is of benefit to communities wishing to make wise climate policy to have an understanding of how their policies may interact with global climate trends.

At first glance, downscaling appears to enact exactly the dialectic between global and spherical views that Ingold calls for. However, on closer inspection, it becomes clear that downscaling makes little space for spherical views of climate and replicates most of the political problems associated with global synopticism.

4 | DOWNSCALING

Downscaling climate information is broadly defined as "transition across scales" to "relate local-and regional-scale climate variables to the larger scale atmospheric forcing" (Hewitson & Crane 1996, p. 85). These downscaled variables are always presented visually – as maps or elevations of specific locales – and may be accompanied by verbal narration or description of the climate "scenarios" projected to obtain in that locale at a certain time under different models of CO_2 forcing. Critical scholarship in environmental and cultural studies has established at least two political dilemmas generated in the process of

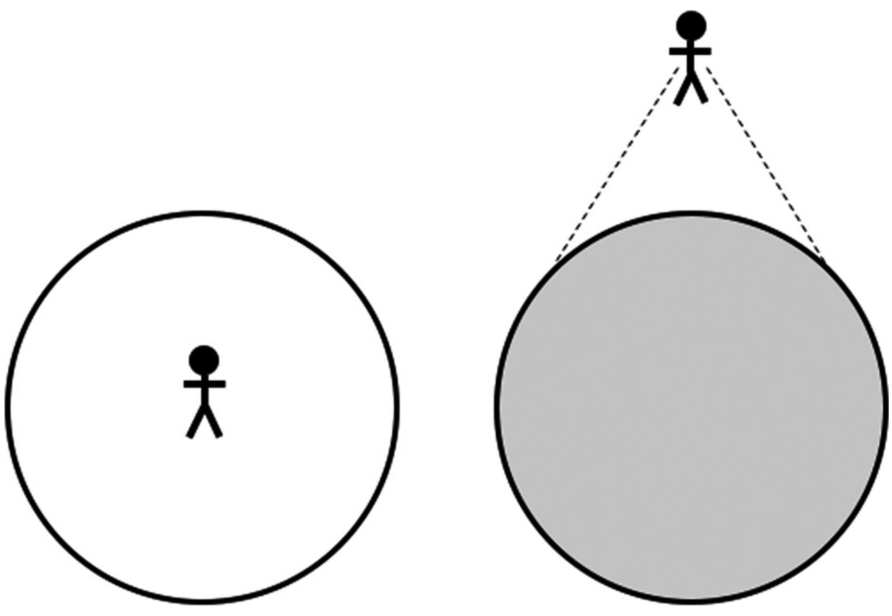

FIGURE 1 Illustration of Spherical view (left) versus Global view (right) of environment and climate (adapted from Ingold, 1993).

downscaling: (1) Downscaled visualizations cancel out conflicting local data; and (2) Downscaled visualizations replicate the hegemonic dynamics of their global sources. Strictly speaking, there is a third problem that arises from downscaling the algorithms and parameters underpinning general circulation models (GCMs; Lahsen, 2005); however, this problem is only secondarily a problem of visualization, and so we leave it to the side here.

First, downscaled climate visualizations are naturally resistant to spherical views of climate that either contradict or are incompatible with quantitative models. While it is true that downscaled climate projections are "ground-truthed" for a particular region with regional records of temperature, precipitation, etc., they cannot smoothly integrate the qualitative, spherical accounts of climate found in communities' stories, memories, or art. Further, downscaled projections tend to cancel out indigenous definitions of key parameters such as vegetation or precipitation type in favor of globalized technical definitions. Two examples of deforestation models – a key variable in climate-change projections due to trees' carbon-storage capacity – will help illustrate the problem here.

In our first example, when forests were monitored globally for the first time in 2012 by remote-sensing, tropical dry forests the size of the Amazon forest escaped the notice of satellite mapping because they fell through the cracks of the resolution of the remote sensing algorithms (de la Barreda-Bautista, 2011). The gap could only be closed with the help of more than 200 assistants from different research institutions who interpreted 200,000 individual VHR-satellite-images, which have a much higher resolution. After this ground-truthing process, estimates of global forest cover grew by nearly ten percent. Here, local data integrated seamlessly and helpfully with global data.

On the flip side, however, Robbins (2001) found that an attempt to use local farmers' knowledge to ground-truth satellite estimates of forest cover in Rajasthan, India, failed – due to a mismatch between their definitions of "forest" and official, governmental definitions inherited from transnational forestry agencies. In short, farmers did not count as "trees" the invasive, shrub-like species that the transnational scheme allowed to count as "trees." Thus, in the farmers' eyes, the official definition generated a grossly inflated estimate of reforestation, one that papered over the true environmental devastation of their homeland while allowing local governmental officials to secure transnational funding awarded to "successful" national reforestation campaigns.

The irony framed by the two examples above – in which globalized views of climate exclude the traditional knowledge of some of the most climate-vulnerable communities – points us toward the second and more serious problem with downscaled climate visualizations, and that is that they replicate the power dynamics of global synopticism. These dynamics begin with the implication that the agent who constructed the synoptic view is the one with the power and authority to act on that scale. Walsh and Prelli (2017, p. 211) found this to be the case in their study of early American ecological maps, in which "The scientific observer is positioned as the only subject able to comprehend ecological bodies and thus govern them." When those scientific observers work for transnational corporations such as Google, a cascade of troubling political effects results: namely, if only technocratic transnational actors can "see" the whole of the climate problem, then they are logically the ones to solve it; those solutions, though enacted locally, will be managed and realized synoptically (Gurevitch, 2014). A paradigmatic example of this sort of "downscaled" climate solution is the Great Garuda seawall, the contract for which was awarded to a Dutch consortium and whose construction has already displaced thousands of coastal Indonesians and ripped up the mangrove swamps they maintained in order to protect their coastline from erosion and subsidence (Sherwell, 2016). It is telling that the namesake shape of this wall – of a giant, spreadwinged eagle – is entirely invisible from the perspective of these local residents; it is only apparent from the perspective of satellites and transnational air travelers.

As evidenced by the Great Garuda and similar transnational geoengineering projects, downscaled climate visualizations conduce to solutions derived from global perspectives and impose the dominant political ideology of that perspective (currently neoliberalism, which treats climate as a global commodity) from above onto local communities no matter how diverse their situations. Herod and Wright (2002) illustrate this dynamic with the metaphor of an octopus whose tentacles touch apparently disconnected points on the seafloor, but whose control and logics nonetheless hover above.

Scholars of climate communication have certainly taken note of the "octopus" problem of neoliberal downscaling. The localized "climate scenarios" generated by Sheppard and colleagues to help communities make climate policy combine synoptic projections of sea-level rise in Canadian coastal cities, for instance, with analytic elevations that take the perspective of local residents, and with verbal narratives (see Shaw et al., 2009, for an example of this approach). These scenarios are developed in consultation with local stakeholders, who help the designers identify the most vulnerable and/or iconic locales. Schroth et al. (2014) have taken a related approach in generating immersive 3D climate video games.

While valuable and effective in many political contexts, the "scenario" approach nonetheless relegates the actual process of downscaling to the backstage – as a set of procedures prerequisite to but not part of the persuasive appeal of the finished scenario. We wish to focus our attention on the dynamic of visual downscaling in and of itself, and so we turn to interactive climate visualization tools, where downscaling is made a linchpin of user experience via the zoom tool.

5 | THE POLITICS OF ZOOM

The zoom tool relates global and local/spherical scales in interactive climate visualizations not physically or literally but via a metaphor. Metaphor counts as one of the four master tropes of rhetoric (along with irony, synecdoche, and metonymy), verbal techniques that help a community invent new norms for learning and acting together. The unique tropical function of metaphor is to help a community understand an unfamiliar domain of knowledge or action (the tenor) by relating it to a familiar domain (the vehicle) via specific features the two share (Black, 1962; Richards, 1936). With time and habitual use, a metaphor becomes naturalized to the point where it shifts from helping invent new norms to maintaining norms.

"Zooming" is just such a metaphor. While multi-lens assemblies had been around since the 17th century, the descriptor "zoom" was first used in a U.S. patent application by Clile Allen in 1902 – and it was already metaphorical in that first usage, importing to the domain of optics connotations of speed and travel from the domain of racing. "Zooming" quickly naturalized to become a standard, nonfigurative term in photography, which it remained for much of the 20th century. But when it was applied to computer visualization (the *Oxford English Dictionary* reports the first usage in this sense from 1965 with increasing usage in the 1980s), the inventive capacity of the zoom metaphor was renewed, as it imported from optics the norm of changing focal lengths from a fixed perspective; this analog norm came to frame what was not at all an analog process – the digital substitution on a fixed screen of a sequence of static "snapshots" of an object, each being displayed at a higher (or lower) resolution.

Using the zoom metaphor, climate service platforms like the World Bank Group's *Climate Change Knowledge Portal* (CCKP) translate the global into the local, the god's eye view into a personalized and detailed view for one's own use. For instance, a CCKP user can mouse over the world map to click on the region of Central America; the page refreshes, and Central America fills the map window; from there the user can click on the country of Nicaragua, and the same procedure localizes the map window to the country's northern and southern borders. At the same time a graph pops up to the right showing average monthly temperature and rainfall for Nicaragua; users can manipulate the timescale of this graph to see roughly how these patterns have changed over the last century; they can also "zoom in" to the timescale of each month to get more specific data. Such online platforms successfully realize Edward Tufte's visual-information-seeking doctrine, which Ben Shneiderman later summarized with the formula "overview first, zoom and filter, then details-on-demand" (Shneiderman, 2003, p. 364; Tufte, 1990).

In platforms like CCKP, the "zoom" metaphor exploits the history of camera development by taking on both a photographic (cartographic) and a cinematic aspect. The cartographic aspect has been sufficiently accounted for by the critical-geographic work on interscalarity reviewed above; the cinematic side of the metaphor, however, has received less analysis. The cinematic is invoked whenever synoptic views of the globe or climate are related to the detail (the singular data point or the closest gaze towards the ground) by simulation of a smooth and continuous process of zooming in on the Earth's surface. Within this conception micro- and macro levels are two ends of a unified continuum, conventionalized by the zoom slider tool of Google Maps.

Cinematic zooming may be most clearly exemplified by Eames and Eames (1968) famous short movie "Powers of Ten," produced in 1968/1977 for an exhibition of the International Business Machines Corporation (IBM). Eames' animated eight-minute moving picture smoothly closed the gaps between the distinct "jumps" of the vertical space journey sketched out in the earlier book *Cosmic View: The Universe in 40 Jumps* by Kees Boeke (1957). "Powers of Ten" can be seen as a visual formula or *visiotype* of global God's eye world perception. The Eames movie reproduced on a cinematic level what already had become imaginable via globes, world maps and later by space technology: A cosmic journey of a detached eye relating sky to ground along a vertical trajectory. The steady frame rate of the film minimized the "jumps" that characterized the Boeke source, rendering a discontinuous process as a seemingly continuous one and thereby *masking* problems of interscalarity.

But these problems persist. As Latour (2014) has pointed out, no human eye could maintain a steady view across the scales presented in "Powers of 10"; in fact, some of the galaxies shown are not even visible to the human eye (Walsh et al., 2017). Even if we replaced the human eye with a camera, that camera could not record in a continuous fashion all the visualizations presented sequentially in the film; in fact, those visualizations come from dramatically different sources – optical and radio telescopes, film cameras, and animations. Thus, the cinematic move from the global to the local entails mutations in quality (i.e., the genre and source of images), not merely quantity (i.e., distance). The seeming continuity of the visualization, the "zoom," is an illusion composed of editing techniques such as fades, blends, and morphs. In this way the zoom metaphor, a trope allowing alignment and comparison between disparate perspectives, becomes confounded with synecdoche, a trope that enforces a part-to-whole relationship: under the force of the synecdoche of zoom, the local is taken for a *literal* part of the global instead of as a *figurative* part.

This slippage from visual *comparison* via metaphor to visual *reduction* via synecdoche is consequential for the politics of interactive downscaled climate visualizations. As Latour (2014) puts the problem:

> This illusion of unhindered movement limits reactions to the ecological crisis, since people think they can talk blandly about, for instance, ‘everything,’ or about the ‘fate of the planet,’ without realizing that what they call ‘everything’ generally tallies with some tiny model in a research bureau or lab … Yet, it would be absurd to deny that differences in time and space are crucial. One cannot pretend that talking about the Amazonian Basin is the same thing as working on a ten-acre experimental station in the Jura. (p. 121)

And yet that is precisely what happens with many zoom-tool climate visualizations: the Amazonian forest is seen as part of Google Earth, and so by the logic of Gurevitch's “Google Warming,” how Western scientists define forests in Jura becomes the definition of forests in the Amazon, regardless of the diversity of those ecological and political contexts.

An example of this politics of zoom can be found in the non-profit Taking Root (https://takingroot.org/), which sells corporations carbon credits produced by a network of tree-planting farmers in the Tropics, primarily Southeast Asia and Central and South America. Client corporations use Taking Root's visualization tools to zoom down into the plots they have “bought” and check on the progress of trees and farmers. The zoom logic here has led to some invasive neoliberal practices. In one village in Nicaragua, farmers participating in the Taking Root program have reported foreign corporate representatives using the GPS capabilities on their smartphones to locate and trespass on private land without permission in order to evaluate forest health. Taking Root has also imposed forestry practices on Nicaraguan farmers taken from Canadian forestry literature, which unsurprisingly produced failed crops. These failed crops were consequential for the Taking Root farmers, as they had converted valuable cropland to tree plantations in order to participate in the program; now, because of crop failures, they were looking at lower payments from Taking Root because they were producing fewer carbon credits (Müller, 2017).

If these are the problems with zoom-tool climate visualizations, what are the alternatives? How can we relate global and spherical views of climate to promote community climate action without reducing climate to the synoptic, transnational perspective. A potential solution lies in restoring “zoom” as a metaphor, i.e., in recognizing it not as a transparent part-to-whole movement but as a technique of layering and comparison among diverse regimes of vision. Those regimes can be robustly and reliably articulated using Latour's conception of “connectivity,” which yields continuity without reduction.

6 | DISCUSSION: CONNECTIVITY AND GLOBAL FOREST WATCH

“Connectivity, yes; scale, no,” Latour writes at the end of his essay “Anti-Zoom” (2014, p. 124). Connectivity enables us to sidestep the paradoxes of interscalarity because

> in practice the data … is always composed of connections (a table with figures in columns, a sequence of sentences, pictures placed side by side, and graphs, to name a few). In truth, it is these connections that are subsequently projected in various formats to provide the impression of describing a particular space and time (in fact, it is always a matter of space-time; a route or trajectory). (p. 123)

Latour goes on to say that the path traced by these connections can be presented as a narrative, and this is one way to articulate global and spherical views of climate without reducing one to the other.

Narrative plays a central role in a second interactive climate-visualization tool, the Global Forest Watch platform. While it doesn't eliminate all of the problems noted above with zoom-tool visualizations, it does substantially mitigate them by countering the zoom-tool interaction with other interactions initiated by the user – primarily the articulation of non-synoptic images and stories of forest and climate with the global model.

Global Forest Watch (GFW) is hosted by the World Resource Institute (WRI). It is an online platform that offers open data on the status of forest landscapes on a global level. Its purpose is “forest monitoring designed for action” (http://www.globalforestwatch.org/). Founded in 1997 as WRI's Forest Frontiers Initiative, its partners started by publishing forest atlases of countries such as Cameroon, Republic of the Congo, and Gabon. Today the digital service is offered to support “stakeholders in the world's forests – concerned citizens, government leaders, buyers and suppliers of sustainable forest products – who seek to better manage forests and improve local livelihoods” (http://www.wri.org). The static atlas went interactive and dynamic when the new online-tool was started in 2011 using the platform of Google Maps. The long list of past and current funding partners and collaborators of the GFW – including the UNEP, civil society organizations, international financial organizations, companies and NGOs – establishes global interest in the tool. The website was designed by Vizzuality, a company based in Spain, the United Kingdom and the U.S., specializing in big data-driven environmental monitoring projects.

A Mercator world map with Europe at its center is provided as the basic interface to obtain up-to-date knowledge about forest losses and forest gains, protection areas, forest fires, commodities related to forest changes and climate impacts of forests like carbon losses. The map is created from satellite images. Eight "base maps" can be chosen as a basic surface to add the data (e.g., satellite, roads, tree hight, landsat, grayscale). The interactive map offers manifold different thematic maps that can be added layer by layer to the basic map. The second main feature is the zoom tool. Using this it is possible to inspect areas with a resolution of 30 × 30 m. Forest loss is depicted in tiny pink dots; forest gain is depicted in blue.

Scaling takes place not only on a spatial but also on a temporal level. The maps contain a timescale starting in the year 2001 and running to the present. The timescale-tool can be used to observe certain periods or points of time within the stretch but also as a movie: If one presses "play" the development of de/reforestation data is played in fast motion, and it quickly becomes clear from the proliferation of pink on the map that more forest has been lost than gained over that time, accelerating noticeably from 2010 to present. Users can select polygons of their own design on the map and, using the analysis tool, get customized forest gain/loss estimates for a given time period. They can also add various "alert" layers, including those that remotely monitor fires and illegal logging (Figure 2).

Most importantly, GFW is receptive to user data. Users can request to upload their own GIS datasets of forest coverage and make them either publicly or privately visible as a layer. Users are also encouraged to submit "stories," which can take the form of pictures, text, or both, and which are located on the map using Google-style pointers (Figure 3); when the "Story" layer is turned on, clicking on a pointer makes the indexed story appear in a pop-up window. Stories range from longer essays by NGOs on reforestation projects to grainy cell-phone pictures of recent illegal logging activities taken by individuals on the ground; most but not all stories are presented in English.

Global Forest Watch retains some of the features of zoom-tool visualizations that we have identified as rhetorically and politically problematic: namely, it presents the move from global to local smoothly, as a synecdochic process of focusing a lens rather than a series of metaphorical comparisons among images of various qualities, sources, and time-stamps. It also imposes algorithms for remote-sensing forest coverage that at times disagree with local histories and even naked-eye observations of new plantations (Müller, 2017).

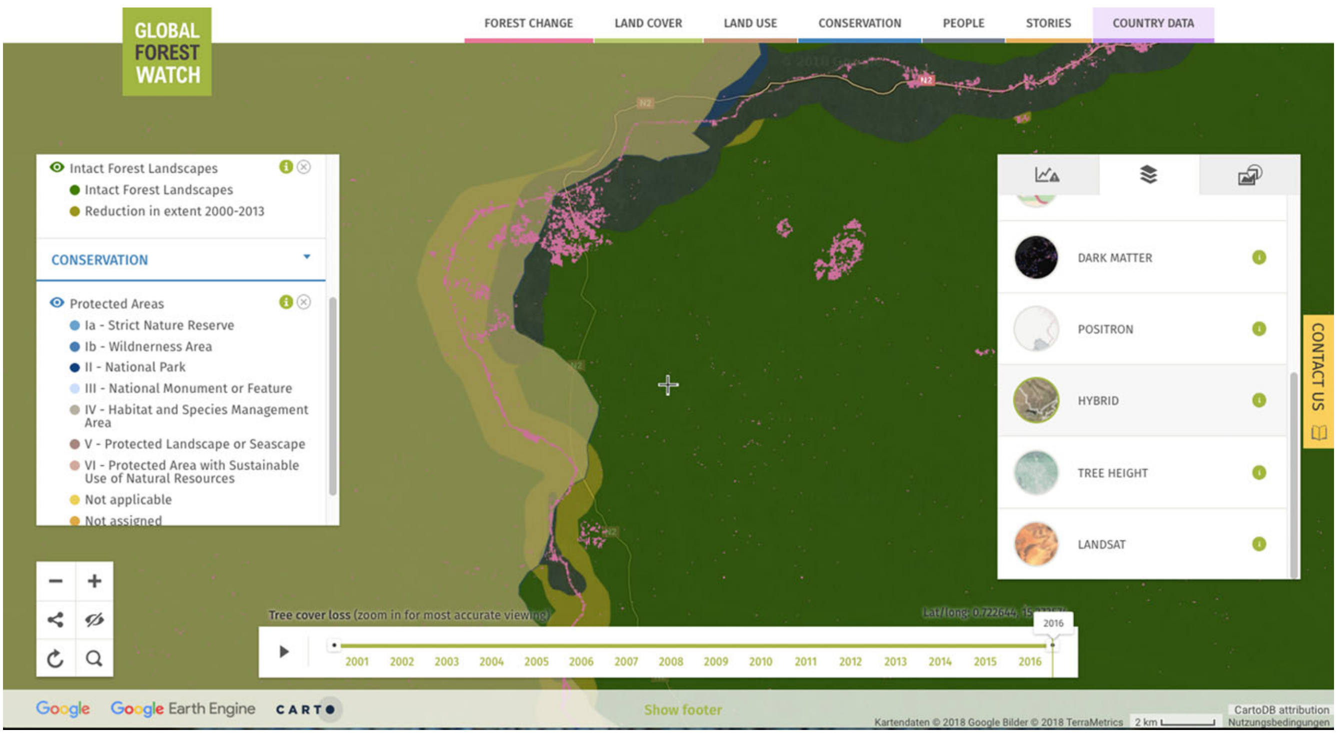

FIGURE 2 Screen-capture of Global Forest Watch in a region of the Republic of Congo with "GLAD Alerts" and "Preservation Areas" layers turned on; notice the incommensurability where deforestation (pale dots) is reported inside the boundaries of the Preserve (dark polygons). *Source*: globalforestwatch.org 2018

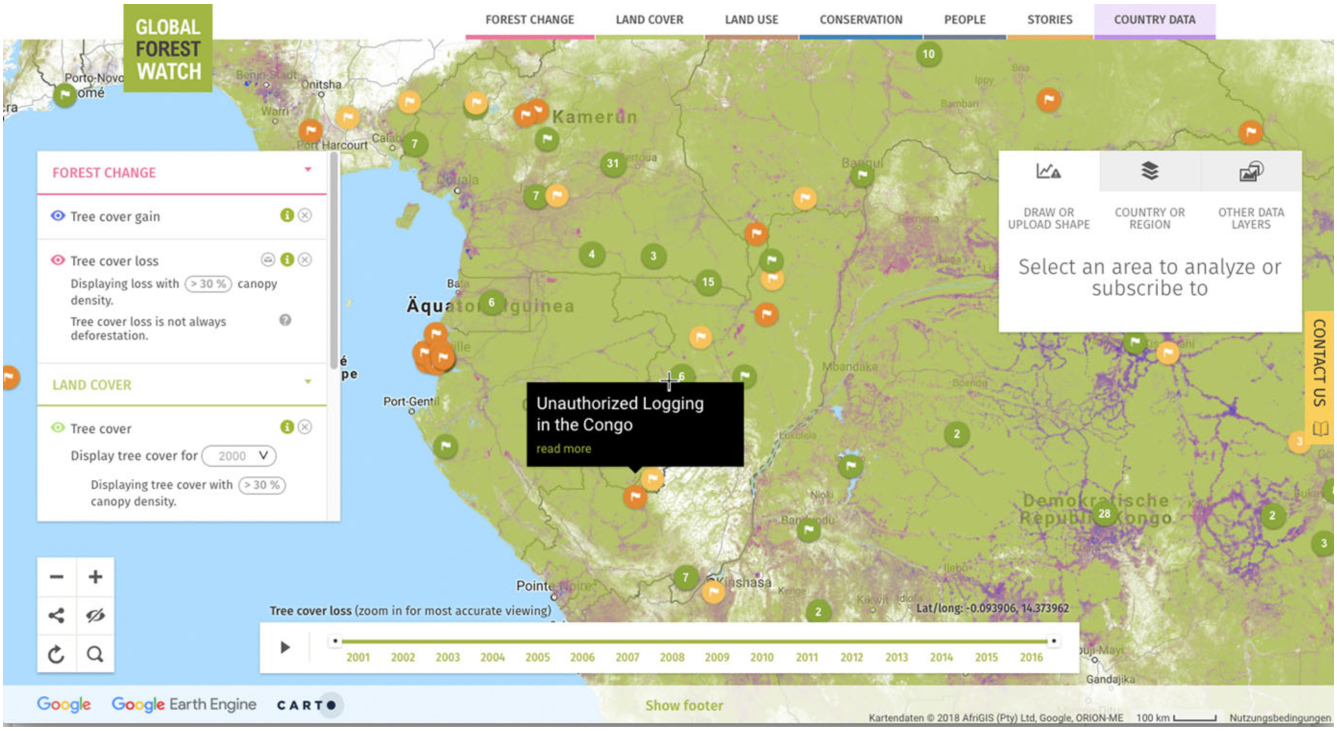

FIGURE 3 Screen-capture of Global Forest Watch "story" expanded over its map locator in the Congo.
Source: globalforestwatch.org 2018

However, it also allows correction and editing of these algorithmic judgments by local datasets and eyewitness reports. Users can upload stories and pictures of reforestation projects that the satellites will not pick up for a year or more. They can make their own connections across space-time by using the polygon, timeline, and analysis tools. And the alert layer enables them to connect the synoptic view of their region in real time with events such as fires and illegal logging in ways that can spur community action.

Nevertheless, GFW's reliance on the Google platform and acceptance of funding from corporations like Unilever and Cargill (who have been criticized for exploitive palm-oil forestry and production practices [Casey, 2014]) imbricates it with transnational capitalism in a way that raises questions about how far it can represent the interests of vulnerable user communities. In addition, although GFW users have more agency than they do in most climate-visualization platforms, there are still strong constraints on that agency – including the need for GFW to approve datasets before they can be integrated in the database, and the highly technical aspects of many parts of the interface, which demand significant digital literacy and resources. So, GFW as exemplar reveals not only the promise but also the challenge of remediating the political problems with zoom-tool visualizations.

7 | CONCLUSION

In this essay we have combined media-studies and rhetorical methods to explicate the political problems with interactive downscaled climate visualizations. The central problematic of the zoom tool is its conflation of the trope of metaphor (comparison between different domains/regimes) with the trope of synecdoche (part-to-whole substitution), which results in a cinematics that transports the disabling politics of global synopticism into localized visualizations. Online interactive global mapping platforms are the means by which these rhetorical tropes materialize; they form the media that are acted upon/within as a rehearsal for actions in the real world like the building of the Great Garuda seawall.

We have suggested an alternative paradigm for interactive downscaled visualizations that seeks to connect, rather than reduce, spherical views of climate to global ones through the use of narrative and user-driven reconfigurations of data. In future work, we plan to apply these insights to develop a more formal set of criteria for effective and equitable interactive climate visualizations and then to apply those criteria to the in-situ evaluation of various tools, including Global Forest Watch, with community stakeholders.

ORCID

Lynda Walsh https://orcid.org/0000-0002-4377-5469

ENDNOTE

[1] More and more initiatives such as the *Global Framework for Climate Services* (GFCS), *Future Earth, World Climate Service*, *Ecosystem Marketplace*, *Climate Change Knowledge Portal*, *Pacific Disaster Network* or national institutions like the *UK Climate Impacts Programme* (UKCIP) and *Climate Service Center Germany* (GERICS) offer services such as modelling of impacts and observation/monitoring devices.

REFERENCES

Adger, W. N. (Ed.) (2006). *Fairness in adaptation to climate change*. Cambridge, MA: Mit Press.

Baake, K. (2003). *Metaphor and knowledge: The challenges of writing science*. Albany, NY: SUNY Press.

de la Barreda-Bautista, B. (2011). Tropical dry forests in the global picture: The challenge of remote sensing-based change detection in tropical dry environments. In E. G. Carayannis (Ed.), *Planet earth 2011 – Global warming challenges and opportunities for policy and practice* (pp. 231–256). London, UK: InTech: Open Access Publisher.

Barton, B. F., & Barton, M. S. (1993). Modes of power in technical and professional visuals. *Journal of Business and Technical Communication*, *7*, 138–162. https://doi.org/10.1177/1050651993007001007

Black, M. (1962). *Models and metaphors: Studies in language and philosophy*. Ithaca, NY: Cornell University Press.

Boeke, K. (1957). *Cosmic view: The universe in 40 jumps*. Omaha, NE: John Day Inc.

Brasseur, L. E. (2003). *Visualizing technical information: A cultural critique*. Amityville, NY: Baywood Publishing.

Casey, M. (2014). Unilever, Cargill push to green their palm-oil chain. *Fortune*. Retrieved from: http://fortune.com/2014/12/17/palm-oil-deforestation-unilever-cargill/

Castree, N., Featherstone, D., & Herod, A. (2007). Contrapuntal geographies: The politics of organising across socio-spatial difference. In K. Cox, M. Low, & J. Robinson (Eds.), *Handbook of political geography*. London, UK: Sage.

Certeau, M. D. (1984). *The practice of everyday life*. London, UK: University of California Press Ltd.

Cosgrove, D. (2008). *Geography and vision: Seeing, imagining and representing the world*. London, UK: I. B. Tauris.

Crampton, J. W. (2001). Maps as social constructions: Power, communication and visualization. *Progress in Human Geography*, *25*, 235–252. https://doi.org/10.1191/030913201678580494

Dragga, S., & Voss, D. (2001). Cruel pies: The inhumanity of technical illustrations. *Technical Communication*, *48*, 265–274.

Eames, C. & Eames, R. (Directors). (1968). *The Powers of Ten*. [Documentary film]. USA: IBM.

Foucault, M. (2007). *Territory, security, population: Lectures at the collège de France, 1977–1978*. New York, NY: Palgrave Macmillan.

Goodnight, G. T. (2012). The personal, technical, and public spheres: A note on 21st Century critical communication inquiry. *Argumentation and Advocacy*, *48*, 258–268. https://doi.org/10.1080/00028533.2012.11821776

Gupta, J., Leeuw, K. V. D., & Moel, H. D. (2007). Climate change: A 'glocal' problem requiring 'glocal' action. *Environmental Sciences*, *4*, 139–148. https://doi.org/10.1080/15693430701742677

Gurevitch, L. (2014). Google warming: Google Earth as eco-machinima. *Convergence: The International Journal of Research Into New Media Technologies*, *20*, 85–107. https://doi.org/10.1177/1354856513516266

Haraway, D. J. (1997). *Modest_Witness@Second_Millennium.Femaleman(C)_Meets_Oncomousetm: Feminism and technoscience*. New York, NY: Routledge.

Herod, A., & Wright, M. W. (Eds.) (2002). *Geographies of power: Placing scale*. Oxford, UK: Blackwell.

Hewitson, B. C., & Crane, R. G. (1996). Climate downscaling: Techniques and application. *Climate Research*, *7*, 85–95. https://doi.org/10.3354/cr007085

Horizon 2020. *Framework Programmes for Research and Technological Development*, created by the European Union. Retrieved from https://ec.europa.eu/programmes/horizon2020/en/

Hulme, M. (2008). The conquering of climate: Discourses of fear and their dissolution. *The Geographical Journal*, *174*, 5–16. https://doi.org/10.1111/j.1475-4959.2008.00266.x

Ingold, T. (1993). Globes and spheres: The topology of environmentalism. In K. Milton (Ed.), *Environmentalism: The view from anthropology* (pp. 209–218). London, UK: Routledge.

Kress, G., & Van Leeuwen, T. (1996). *Reading images: The grammar of visual design*. New York, NY: Routledge.

Lahsen, M. (2005). Seductive simulation? Uncertainty distributions around climate models. *Social Studies of Science*, *35*, 895–922. https://doi.org/10.1177/0306312705053049

Latour, B. (2014). Anti-zoom. *Contact, catalogue de l'exposition d'Olafur Eliasson*, Paris.

Lorenz, S., Dessai, S., Forster, P. M., & Paavola, J. (2015). Tailoring the visual communication of climate projections for local adaptation practitioners in Germany and the UK. *Philosophical Transactions of the Royal Society A*, *373*, 143–155. https://doi.org/10.1098/rsta.2014.0457

Mahony, M., & Hulme, M. (2016). Epistemic geographies of climate change: Science, space and politics. *Progress in Human Geography*, *42*, 395–424. https://doi.org/10.1177/0309132516681485

Moore, A. (2008). Rethinking scale as a geographical category: From analysis to practice. *Progress in Human Geography*, *32*, 203–225. https://doi.org/10.1177/0309132507087647

Morseletto, P. (2017). Analysing the influence of visualisations in global environmental governance. *Environmental Science & Policy*, *78*, 40–48. https://doi.org/10.1016/j.envsci.2017.08.021

Morton, S., Martin, M., Mahood, K., & Carty, J. (Eds.) (2013). *Desert lake: Art, science and stories from Paruku*. Collingwood, Vic.: Csiro.

Moser, S. C. (2016). Reflections on climate change communication research and practice in the second decade of the 21st century: What more is there to say? *Wiley Interdisciplinary Reviews: Climate Change*, *7*, 345–369. https://doi.org/10.1002/wcc.403

Müller, B. (2017). *Re: Personal communication about anthropological work in Nicaragua*.

O'Neill, S., & Nicholson-Cole, S. (2009). "Fear won't do it": Promoting positive engagement with climate change through visual and iconic representations. *Science Communication*, *30*, 355–379. https://doi.org/10.1177/1075547008329201

Perelman, C., & Olbrechts-Tyteca, L. (1969). *The new rhetoric*. Trans. J. Wilkinson & P. Weaver. Notre Dame, IN: Notre Dame University Press.

Richards, I. A. (1936). The command of metaphor. *The Philosophy of Rhetoric*, *1*, 115–138.

Robbins, P. (2001). Fixed categories in a portable landscape: The causes and consequences of land-cover categorization. *Environment and Planning A*, *33*, 161–179. https://doi.org/10.1068/a3379

Rudiak-Gould, P. (2013). "We have seen it with our own eyes": Why we disagree about climate change visibility. *Weather, Climate, and Society*, *5*, 120–132. https://doi.org/10.1175/WCAS-D-12-00034.1

Schneider, B. (2012). Climate model simulation visualization from a visual studies perspective. *Wiley Interdisciplinary Reviews: Climate Change*, *3*, 185–193. https://doi.org/10.1002/wcc.162

Schneider, B. (2016). Burning worlds of cartography. A critical approach to climate cosmograms of the Anthropocene. *Geography and Environment*, *3*, e00027. https://doi.org/10.1002/geo2.27

Schneider, B. (2018). *Klimabilder. Eine genealogie globaler bildpolitiken von klima und klimawandel (Images of climate*. A genealogy of global image politics of climate and climate change), Berlin, Germany: Matthes & Seitz.

Schneider, B., & Nocke, T. (2018). *The feeling of red and blue—A constructive critique of color mapping in visual climate change communication. Handbook of Climate Change Communication*. Vol. 2. Cham, Switzerland: Springer.

Schroth, O., Angel, J., Sheppard, S., & Dulic, A. (2014). Visual climate change communication: From iconography to locally framed 3D visualization. *Environmental Communication*, *8*, 413–432. https://doi.org/10.1080/17524032.2014.906478

Shaw, A., Sheppard, S., Burch, S., Flanders, D., Wiek, A., Carmichael, J., Robinson, J., & Cohen, S. (2009). Making local futures tangible—Synthesizing, downscaling, and visualizing climate change scenarios for participatory capacity building. *Global Environmental Change*, *19*, 447–463. https://doi.org/10.1016/j.gloenvcha.2009.04.002

Sheppard, S. R. (2012). *Visualizing climate change: A guide to visual communication of climate change and developing local solutions*. London, UK: Routledge.

Sherwell, P. (2016, November 22). $40bn to save Jakarta: The story of the Great Garuda. *The Guardian*. Retrieved from https://www.theguardian.com/cities/2016/nov/22/jakarta-great-garuda-seawall-sinking

Shneiderman, B. (2003). *The eyes have it: A task by data type taxonomy for information visualizations. The craft of information visualization*. San Francisco, CA: Morgan Kaufmann.

Smith, N. (1992). Geography, difference and the politics of scale. In J. Doherty, E. Graham, & M. Malek (Eds.), *Postmodernism and the social sciences*. New York, NY: St. Martin's Press.

Stehr, N., & Von Storch, H. (1999). An anatomy of climate determinism. *Wissenschaftlicher Rassismus-Analysen Einer Kontinuität In Den Human-Und Naturwissenschaften. Campus-Verlag Frankfurt. Am-New York*, 137–185.

Taylor, P. J. (1982). A materialist framework for political geography. *Transactions, Institute Of British Geographers, Ns*, *7*, 15–34.

Tufte, E. R. (1990). *Envisioning information*. Cheshire, CT: Graphics Press.

United Nations (2015). *Paris agreement* [Online]. Retrieved from http://Unfccc.Int/Files/Essential_Background/Convention/Application/Pdf/English_Paris_Agreement.Pdf

Walsh, L., & Prelli, L. J. (2017). Getting down in the weeds to get a God's-eye view: The synoptic topology of early american ecology. In L. Walsh, & C. Boyle (Eds.), *Topologies as techniques for a post-critical rhetoric*. New York, NY: Palgrave Macmillan.

Walsh, L., Rivers, N. A., Rice, J., Gries, L. E., Bay, J. L., Rickert, T., & Miller, C. R. (2017). Bruno Latour on rhetoric. *Rhetoric Society Quarterly*, *47*, 403–462. https://doi.org/10.1080/02773945.2017.1369822

Wilbanks, T. J., & Kates, R. W. (1999). Global change in local places: How scale matters. *Climatic Change*, *43*, 601–628. https://doi.org/10.1023/A:1005418924748

WMO. World Meteorological Organization. Retrieved from https://public.wmo.int/en

How to cite this article: Schneider B, Walsh L. The politics of zoom: Problems with downscaling climate visualizations. *Geo: Geography and Environment*. 2019;e00070. https://doi.org/10.1002/geo2.70