“Memory Effects” and Dark Histories

Ecological Light-Pollution Research and Nazi Legacies at Lake Stechlin

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Abstract Ecologists’ concept of “memory effects” considers how past environments shape current and future ones. Drawing on ethnographic research and historical scholarship, this essay uses their concept to ask what scientists remember and what they forget, and to expand ecologists’ definition of the environment. The author argues that contemporary ecological light-pollution research in greater Berlin can take place because of the site’s longer naturalcultural history, which includes the Nazi regime’s role in creating the nature reserve where Lake Stechlin and scientific infrastructure—the “LakeLab”—are located. Reserve status protected the area from suburbanization and artificial light at night. Current light-pollution research there is thus entangled with and indebted to Germany’s dark history—giving the phrase a poignant double meaning. This essay interweaves three parallel but entwined narratives: the author’s ethnographic fieldwork, a history of the site, and the area’s Nazi history. The resulting experimental form uses ideas such as enclosures and sediments to frame these intertwined histories, and juxtaposition and resonances among stories to do analytic work. In the process the essay urges light-pollution scientists to wrestle with a dark, unjust history. Across the globe scientists, scholars, and citizens alike have been increasingly forced to reckon with landscapes and their histories of violence, dispossession, and oppression in diverse contexts.

Keywords light pollution, memory, nature reserve, Nazi regime, Ravensbrück

> The [water conditions in the] bottom [of the enclosures are] not identical so whatever the memory effects on the bottom [are, they] will, then, over time probably influence a bit of the [experiments’] outcome.
> —Scientist at the LakeLab, September 2018

An addendum elaborating narrative rationale with detailed footnotes and full acknowledgments is available on my website: https://sts.cornell.edu/sara-b-pritchard.

Environmental Humanities 16:1 (March 2024)
DOI 10.1215/22011919-10943129

In an interview a scientist used "memory effects" to help explain the results of ecological light-pollution research conducted at Lake Stechlin near Berlin, Germany.[1] "Although plants cannot remember," ecologists Kiona Ogle and Jarrett J. Barber wrote in 2016, "we use 'memory' as a metaphor to refer to the effect of the past on current and future plant and ecosystem functioning." Simon Besnard and his coauthors went further, declaring that "memory effects can be defined as the influence that past events have on the present or future responses of an ecosystem to environmental conditions."[2]

These scientists use memory as a synonym for history, reflecting the idea in the life sciences since Darwin that biological entities have and are products of history. Although the ecologists think of memory and history as interchangeable, they specifically use the word *memory*. In contrast, scholars in the humanities are careful to distinguish between history and memory and have demonstrated how remembering is always also forgetting—allusions to the political work both history and memory perform, including but not limited to place.[3]

In this essay I draw on ethnographic research and select historical scholarship to ask what these scientists are remembering—and forgetting—and thereby expand their definition of the environment. I ask us to remember "*as* or *with* a lake, its complexities, and its unhealed traumas."[4]

Contemporary ecological light-pollution research near Berlin can take place because of the research site's longer naturalcultural history, which includes the Nazi regime's role in creating the nature reserve where Lake Stechlin and scientific infrastructure—the "LakeLab"—are located.[5] Reserve status protected this region from suburbanization and artificial light at night. Current light-pollution research at Lake Stechlin is therefore entangled with and indebted to Germany's dark history—giving the phrase a poignant double meaning.[6]

Inspired by scholar-writers working in creative nonfiction, I weave this essay through three parallel yet entwined narratives: my ethnographic fieldwork, a history of the site, and the region's Nazi history.[7] The resulting experimental form—a braided

1. In 1959 the East German government established a limnology field station at Lake Stechlin. In 2011–12, a large, experimental platform, the "LakeLab," was constructed in the lake nearby. An interdisciplinary scientific project on "Illuminating Lake Ecosystems" received funding to work at the LakeLab after it was completed. I discuss the histories of this institution, infrastructure, and project below. I seek to distinguish among them in this essay, but their infrastructure and staff overlap.

2. Ogle and Barber, "Plant and Ecosystem Memory," 16–22; Besnard et al., "Memory Effects of Climate," 2.

3. Crucial early work on history and memory includes Nora, "Between Memory and History"; Trouillot, *Silencing the Past*.

4. Smith, "Anxieties of Access," 245.

5. On nature-culture and naturecultures, see Latour, *We Have Never Been Modern*, 7; Haraway, *Companion Species Manifesto*, 1; Haraway, *When Species Meet*, 16.

6. All landscapes have long, often complicated histories. Distinct places can be connected in unexpected ways. The landscapes I discuss here are particularly fraught. To be clear, current scientists are not responsible for the past. Nonetheless, their work is embedded within this place. Its history merits greater reflection.

7. Select works that combine history with ethnography and/or memoir include Brown, *Manual for Survival*; Demuth, *Floating Coast*; Sachs, *Arcadian America*; Solnit, *Savage Dreams*. Several relevant literatures are enormous,

narrative—uses concepts such as enclosures and sediments to frame these entangled histories.[8] My analysis of these entwined histories is grounded in the juxtaposition of and resonances among stories. This narrative form highlights how the past haunts the present at Lake Stechlin and beyond.

Braided narrative invites us to consider how we analyze and theorize—the ways that juxtaposition, resonances, and ripples across time and space do analytic work. It suggests how genre and form can embody theoretical commitments in accessible ways, in this case the concept of natureculture and the mutual shaping of technoscience and society. In contrast, a chronological narrative too easily obscures the continuing presence of the past in the present. I move between narrative voices to describe this past—particularly *this* past—because a disembodied narrator can dehumanize history predicated on mass dehumanization.

I adopt Jay Cephas's idea of critical closeness—instead of critical distance—to deepen the reader's engagement with this site's past and its persistent tendrils into the present.[9] I hope interweaving these braided narrative strands heightens the essay's impact and emphasizes the moral and political stakes of this history, memory, and simultaneous forgetting. In addition to the contributions this original empirical case makes, my attention to genre and form aims to speak to many humanities and interpretive social sciences disciplines, including the environmental humanities.

Scientists working at Lake Stechlin conduct research in a place with a dark, tragic—but not unique—history. Across the globe scholars and the public have increasingly been forced to contend with landscapes of violence, dispossession, and oppression. From imperialism, settler colonialism, and enslavement to the fascist regime discussed in this essay, landscapes are not blank slates.[10] The history of science and science studies have demonstrated how such historical processes shape scientific research and knowledge itself. These are common insights in the environmental humanities and science studies, but I invite scientists to explicitly address politics in their work and publications.

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including history and memory in Germany; history of the Nazi regime, conservation, and environmentalism; debates about Nazi concentration camps, including types and categorization; histories of resistance; and history of ecology in Germany and beyond. This essay cannot do justice to any of these vital literatures, let alone all of them.

8. For reflections on structure, see Nelson, "Experiments with Structure." A science studies classic in experimental form is Latour, *Aramis*. Kelman, *Misplaced Massacre*, uses form to wrestle with history and memory. See also Abrahamsson and Bertoni, "Compost Politics"; Eisterer, "Spatial Practices"; Lorimer, "Rot"; Raffles, *Book of Unconformities*.

9. Cephas, "Repair." Bruno Latour has proposed "critical proximity." I prefer Cephas's term because of its implied intimacy.

10. Other scientists concerned about light pollution are implicated in these patterns. Many astronomers troubled by the "colonization" of space by StarLink satellites, for instance, have generally dismissed the concerns of Indigenous communities whose land is occupied by observatories. See Prescod-Weinstein, *Disordered Cosmos*; Prescod-Weinstein et al., "Reframing Astronomical Research"; Swanner, "Mountains of Controversy"; Swanner, "Instruments of Science."

Site/Sight

The bus dropped me off at the plaza. I dragged my suitcase across the cobblestones toward the train station. Bouncing along slowly, I glanced at a sign to my left—and stopped. The tourist bureau's sign showed popular destinations for visitors. Below it a smaller, makeshift sign caught my eye. A crude map marked with dotted lines led to the memorial site at Ravensbrück—an all-women's labor camp run by Germany's National Socialist regime during World War II. Local school children had made this rudimentary map. Intermittent lines of fading paint on the cobblestones directed tourists to Ravensbrück, a kilometer away.

Uneasy, I continued to the train station, bought a ticket, and waited for my train to Berlin. Flashing signs indicated the train was delayed, not once but twice. The Deutsche Bahn—*really*? I paced in the crisp September weather, looking at billboards posted along the platform. I began feeling queasy. Finally my train came. I couldn't stop thinking about Ravensbrück.

* * *

The bus had taken me ten kilometers from the village of Neuglobsow to the town of Fürstenburg/Havel. Neuglobsow, ninety kilometers north of Berlin, nestles next to Lake Stechlin, and Fürstenburg next to Lake Schwedt. They lie within northeastern Germany's Mecklenburg Lake District. The region's landscape and "lakescape" resemble the Finger Lakes close to my home in upstate New York.

Glaciers carved out six-hundred-odd lakes thousands of years ago in this region. Peasants lived in this area in the medieval era, farming, fishing, and logging. War and disease decimated villages in the fourteenth century. It took nearly four hundred years for human populations to recover.[11]

Several changes during the eighteenth century altered Lake Stechlin's human and natural histories. While the Lake District's human population rose, Berlin's increased even faster. In Berlin—named capital of Prussia in 1701—demand for building materials and firewood soared. Between 1745 and 1750 a rafting canal known as the Polzow Canal was constructed to connect several lakes, including Stechlin and Nehmitz, to the Havel River. The canal enabled loggers to float trees from farther within the forest and connected previously isolated lakes. It served the timber industry for three decades; then deforestation forced loggers to move on, rafting ended, and the canal fell into disuse. Meanwhile tar furnaces and glassworks were established in villages near Lake Stechlin. Both industries relied heavily on wood, worsening deforestation.[12]

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The Nazi regime opened the Ravensbrück camp in May 1939 in the village of the same name on the outskirts of Fürstenburg. It was the main concentration camp for women

11. Casper, *Lake Stechlin*, 9–10, 15–17.
12. Casper, *Lake Stechlin*, 10, 18.

internees.[13] Only the women's subcamp at Auschwitz-Birkenau was bigger. At its height Ravensbrück interned 45,000 women at one time; over the camp's six-year existence an estimated 130,000 women passed through its doors.[14]

An SS officer likely proposed the camp's location because he, like other top Nazis, including SS Commander Heinrich Himmler, had a country estate nearby. The Nazi regime had practical reasons for choosing the site, such as the train station and adequate water, as well as strategic ones—a forested landscape that could obscure its atrocities. Himmler also selected the location because he believed cleansing German blood should occur near nature, with forests holding a special place in Nazi ideology.[15]

Decades later survivor and member of the Dutch resistance Selma van de Perre remembered arriving at Ravensbrück on September 8, 1944: "The sliding doors of the cattle wagon opened and we caught our first glimpse of what we later found out was Ravensbrück, in northern Germany. Ironically, this grim and terrible place is located by a large lake—the Schwedtsee [Lake Schwedt]—in beautiful surroundings, but we couldn't see anything of that."[16]

According to historian Sarah Helm, "There have been many excuses for marginalizing this camp." Historian Thomas Laqueur has argued that Ravensbrück does not fit as easily into established narratives about the history of Nazi Germany, the history of the Holocaust, and Jewish history. Insa Eschebach, director of the Ravensbrück memorial site, adds, "We were always on the margins of the story."[17]

* * *

Histories of landscapes are not necessarily readily visible.

Experiments

That September I spent two weeks in Neuglobsow following scientists studying "ecological light pollution"—a term coined in 2004.[18] Light pollution is understood as excessive, misdirected, obtrusive, and/or disruptive artificial light at night. Terrestrial anthropogenic light blocks the ability to see celestial light, especially in cities and industrial areas.

Some scientists studying artificial light at night measure, monitor, and model night-sky brightness under natural and artificial conditions. These researchers identify and

13. I use "internment," "internees," and "victims," rather than imprisonment and prisoners, to differentiate between processes and people at concentration camps and the "normal" prison system in Nazi Germany.

14. Helm, *Ravensbrück*, xviii; *Holocaust Encyclopedia*, United States Holocaust Memorial Museum, s.v. "Ravensbrück," https://encyclopedia.ushmm.org/content/en/article/ravensbrueck (accessed December 9, 2021).

15. Helm, *Ravensbrück*, 17, 20, 101, 638. On the industrialization and "business" of death in Nazi Germany, see Allen, "Puzzle of Nazi Modernism"; Bartov, *Murder in Our Midst*; Allen, *Business of Genocide*. On forests and Nazi ideology, see Imort, "'Eternal Forest.'"

16. van de Perre, *My Name Is Selma*, xiii–xiv.

17. Helm, *Ravensbrück*, xix, 646, 649–50, 654 (quotations from 649); Laqueur, "If This Is a Woman."

18. Longcore and Rich, "Ecological Light Pollution"; Rich and Longcore, *Ecological Consequences*.

track changes in the night, contributing to what I call *environmental histories of night*.[19] Ecologists studying nocturnal anthropogenic light seek to understand how this phenomenon affects species, biological processes, and ecosystems on the ground. As one US National Park Service researcher told me (pers. comm., April 2015), "we" have been conducting "a grand experiment" with nighttime artificial light "on a planetary scale" since the late nineteenth century. Ecologists run controlled experiments to analyze aspects of this real-world experiment. At Lake Stechlin an interdisciplinary team seeks to understand the ecological effects of artificial light at night on aquatic ecosystems.[20]

* * *

The naturalcultural history of the Lake Stechlin area changed when German realist writer Theodor Fontane published *Der Stechlin* in 1898. Lake Stechlin provided the backdrop to his novel. Fontane's descriptions of the beauty of the lake and surrounding forest—which had regrown over the previous century—popularized the region for tourists. By the early twentieth century Lake Stechlin had become a frequent destination for weekends and holidays.[21]

In 1898 the Prussian state bought back some land in the Lake District, thereby regulating development. The state also established a fish farm on Lake Stechlin's southern shore, where a scientific field station would be built sixty years later.[22] This is where researchers would study ecological light pollution five decades after that—and where I would eventually layer my study of them and their work.

* * *

As historians Helm and Laqueur argue, Ravensbrück does not fit as easily into established histories for several reasons. Put bluntly those interned were too female, too gentile, too political, too international, and purportedly too lesbian. Some victims of Nazi persecution at Ravensbrück became implicated in oppressing other internees—and worse. In March 1942 Himmler ordered the camp to train female guards for the new women's section at Auschwitz.[23]

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19. On environmental histories of night, see Flack, "Dark Trails," and my book manuscript, "Night as Environment: Light Pollution and the Anthropocene," in progress. For key studies that map night-sky brightness over time, see Cinzano, Falchi, and Elvidge, "First World Atlas"; Falchi et al., "New World Atlas."

20. In "Nocturnalism" (1940) Orlando Park hypothesized why scientists rarely studied nocturnal ecologies; Kevin J. Gaston updates this idea in "Nighttime Ecology."

21. Casper, *Lake Stechlin*, 2–6, 18. Elites sought "natural" areas to escape industrialization and urbanization, usually in ways that reproduced settler colonialism, racism, sexism, and/or xenophobia. For the German (and specifically Nazi) context, see Lekan, *Imagining the Nation in Nature*; Uekoetter, *Green and the Brown*.

22. Casper, *Lake Stechlin*, 18. On research stations in the history of science, see Alagona, "Sanctuary for Science"; Vetter, "Labs in the Field?"; de Bont, *Stations in the Field*; Raby, *American Tropics*; de Bont, "World Laboratory"; Alagona and Paulson, "From the Classroom"; Hennessy, *On the Backs of Tortoises*.

23. Helm, *Ravensbrück*, 50–53, 182–89, 194, 649–50.

Infrastructures of experimentation—scientific field stations, concentration camps.

Experimental subjects—more-than-humans, people treated as less-than-human.

Enclosures

Scientists received a €6 million grant from Germany's Federal Ministry of Education and Research to build a lake laboratory during the winter of 2011–12.[24] The LakeLab is a floating, experimental platform in Lake Stechlin (fig. 1)—a classic example of Big Ecology.[25] The goal is "to conduct large-scale ecological experiments under realistic conditions in the LakeLab, thus combining the advantages of field and laboratory research."[26] Hence, LakeLab.

The LakeLab floats on Lake Stechlin approximately two hundred meters from the lake's southern shore. Its central "mesocosm"—or enclosure—is thirty meters in diameter and surrounded by twenty-four smaller enclosures (each nine meters in diameter) in two alternating rings. The mesocosms are held together by steel cables and encircled by a two-meter floating walkway. Another wide walkway crosses the enclosures at what researchers call twelve o'clock and six o'clock. Narrower, bouncy walkways cross at three o'clock and nine o'clock. The platform is anchored to the lake bottom to keep the LakeLab from drifting.

Each nine-meter-diameter enclosure serves as an individual experimental unit (fig. 2). Its walls are made of heavy plastic sheets fastened at the top to a floating aluminum ring and stabilized by supporting structure underwater. The sheet bottoms are embedded in the lake's sediments, from seventeen to twenty meters down, to prevent water from flowing in or out. Each enclosure contains approximately 1,200 cubic meters of lake water and is thus a mini-lake within Lake Stechlin.[27]

Scientists try to control experimental conditions in each enclosure.[28] Researchers can run the same experimental parameters in multiple mesocosms to achieve scientific replicability.[29] Indeed the LakeLab has the "largest highly replicated [*sic*] freshwater mesocosms" in the world.[30]

24. Another resonance: the Nazi regime killed six million Jews.

25. The material in this subsection is based on the LakeLab's website (www.lake-lab.de/) as of January 25, 2022. The updated website as of November 8, 2023, includes some but not all of this information. See Leibniz Institute of Freshwater Ecology and Inland Fisheries (hereafter IGB), "LakeLab," https://www.igb-berlin.de/en/infrastructure/lakelab (accessed November 8, 2023); Coleman, *Big Ecology*.

26. IGB, "LakeLab," https://www.igb-berlin.de/en/infrastructure/lakelab (accessed November 8, 2023). Early work in the history of the field sciences includes Kuklick and Kohler, "Science in the Field"; Kohler, *Landscapes and Labscapes*. Select work building on these conversations includes Henson, "Invading Arcadia"; Vetter, *Knowing Global Environments*; Vetter, *Field Life*.

27. IGB, "LakeLab: Design," https://www.igb-berlin.de/en/infrastructure/lakelab (accessed November 8, 2023).

28. As scholars have repeatedly demonstrated, humans trying to control nonhuman beings and processes often fail. Scholarship on agency and nature is vast. See, for example, Nash, "Agency of Nature."

29. IGB, "LakeLab: Equipment," https://www.igb-berlin.de/en/infrastructure/lakelab (accessed November 8, 2023). Of note, the 2019 website emphasized replicability more than the 2022 and 2023 versions.

30. Aquacosm, "Mesocosm Facilities for Research on Marine and Freshwater Ecosystems," https://www.aquacosm.eu/2018/03/13/mesocosm-facilities-for-research-on-marine-and-freshwater-ecosystems/ (accessed September 9, 2019).

Figure 1. Aerial view IGB LakeLab. Photo: Martin Oczipka, IGB and HTW-Dresden. Image courtesy of IGB LakeLab.

Figure 2. One of the LakeLab's nine-meter-diameter enclosures. Note the concentric lighting "rings" above the mesocosm. Photograph by author.

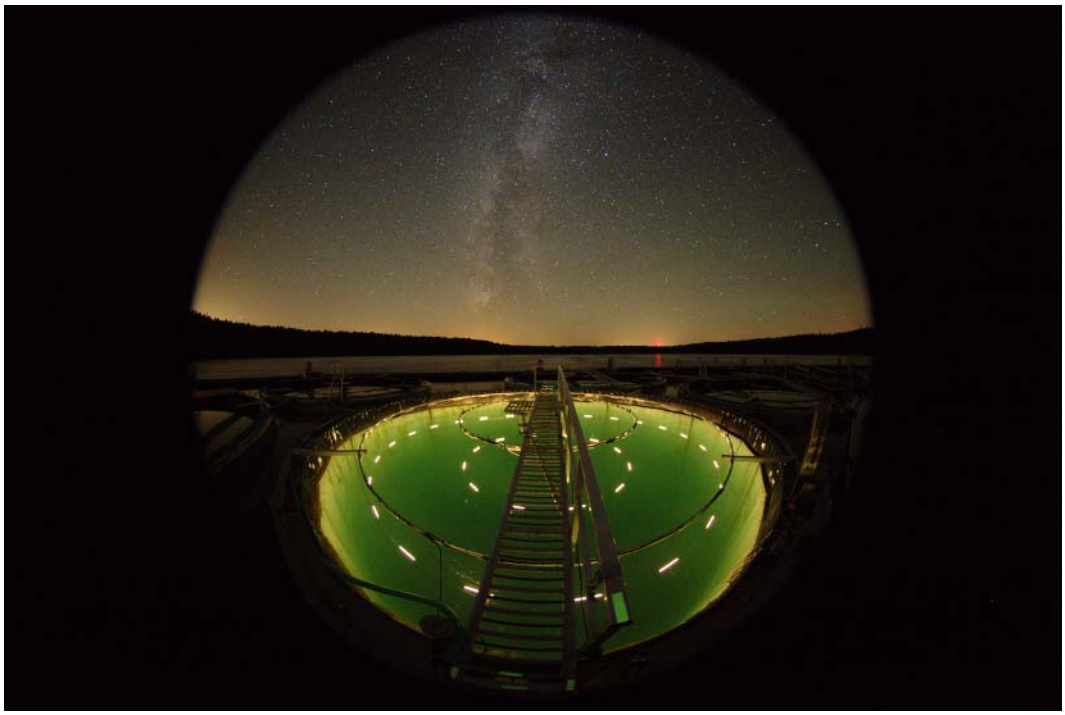

Figure 3. Fish-eye-view photograph of an illuminated nine-meter-diameter enclosure at night. Image courtesy of Andreas Jechow.

Some of the LakeLab's first experiments focused on "illuminating lake ecosystems" thanks to a grant of that name (fig. 3).[31] Physicists, engineers, and technicians from the project's scientific team designed and installed lighting "rings" above some enclosures, creating diffuse light at night that is both beautiful and eerie.

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As Berlin sprawled and with the attention garnered by Fontane's novel the Lake Stechlin area became more a lakescape of leisure than of labor.[32] In 1929 the Brandenburg Provincial Commission for the Preservation of Natural Monuments proposed a nature reserve in part of the Lake District, including Lake Stechlin and the surrounding forest. It was not until 1938 that the Nazi regime established a 1,774-hectare reserve, which included Lake Stechlin—three years after the Reich Nature Protection Law of 1935 and almost exactly one year before the opening of Ravensbrück. The nature reserve thus materializes one half of the Nazi ideology of "blood and soil."[33] Although the name, boundaries, and regulations have changed several times over the past eighty years, Lake Stechlin has

31. IGB, "ILES: Illuminating Lake Ecosystems," https://www.igb-berlin.de/en/project/iles (accessed November 8, 2023).

32. Casper, *Lake Stechlin*, 3, 18; White, "'Are You an Environmentalist'"; Andrews, *Killing for Coal*.

33. Bassin, "Blood or Soil?" On materialization, see Murphy, *Sick Building Syndrome*.

remained part of the reserve ever since, serving as the core of what is now the Stechlin-Ruppiner Land Nature Park.[34]

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At times names matter. According to most historians Ravensbrück was not a death or extermination camp but a labor camp. Ravensbrück internees were forced to labor at the Siemens factory in Fürstenberg. By October 1944 camp commanders had sent thousands of them to thirty-three subcamps spanning German territory to work in factories essential to the war effort.[35]

Germany's central office for the investigation of Nazi war crimes agrees with these historians. It officially declared that Ravensbrück was "not a death camp." Therefore, it is no longer looking into crimes by SS officers or guards at Ravensbrück.[36]

* * *

Enclosures—for science, of nature, of people.

Of *certain* people.

Counting

I was at Lake Stechlin to observe weekly sampling for the "Illuminating Lake Ecosystems" project's latest field season. In 2016 scientists used the LakeLab to study how three levels of artificial light at night affected aquatic organisms. In 2018 they were back, studying the effects of nocturnal anthropogenic light, introduced sediments, or both on those organisms.

At Big Ecology sites like the LakeLab sampling water is a complex, large-scale effort. During my second week there one scientist took me out on the platform to explain the layout and process. As I watched and practiced over the next hour, I kept thinking the sampling method was extremely Fordist.[37] It required a precise division of labor and choreography of bodies, objects, and techniques—without anyone or anything falling into the lake or an enclosure. Actual sampling took place before dawn with researchers working by celestial light (if any) and red headlamps to protect their night vision.

34. Casper, *Lake Stechlin*, 480; IGB, "Lake Stechlin: History of the Lake," https://www.igb-berlin.de/en/lake-stechlin (accessed November 8, 2023). On the 1935 Nazi nature protection law, see Closmann, "Legalizing a *Volksgemeinschaft*."

35. Helm, *Ravensbrück*, 292, 422–26.

36. Helm, *Ravensbrück*, 654. The Nazi regime had its own camp classification system; see *Holocaust Encyclopedia*, United States Holocaust Memorial Museum, s.v. "Concentration Camp System: In Depth," https://encyclopedia.ushmm.org/content/en/article/concentration-camp-system-in-depth (accessed November 22, 2022.). Historians have sought to honor distinctions among camp types to recognize the atrocities victims experienced (or did not experience). Many victims have also maintained distinctions for reasons of identity, resistance, refugee status, and restitution. These categories matter and have had life-or-death consequences. In my view what matters most is victims' perspectives. My thanks to S. E. Eisterer for her expertise.

37. Hounshell, *From the American System*.

Researchers meet at the dock at the appointed time (4:45 in the morning when I was there), ride out to the LakeLab in two boats, and disperse in teams of three. One person stands on a platform above the middle of their team's first enclosure with a ten-meter plastic hose, dipping it into the center of the mesocosm to a prearranged depth. He carefully raises the hose vertically out of the water, over his head.[38] Then he shimmies the hose through his hands, pouring water into a twenty-liter plastic carboy—like one used to brew beer—that the second team member holds. The third person dispenses water from the carboy into three small plastic containers. The team repeats this process for each assigned enclosure, usually five or six. Meanwhile, others schlep the carboys back to shore where a filling team dispenses the water into more containers. Once sampling has finished, some researchers start work immediately. Others share equipment and must wait their turn. Still others go back to the guest house in Neuglobsow, nap, eat, and return to the field station later that morning.

All of these tasks seem easy enough. But as I discovered that afternoon on the platform, they are hard in practice. Seemingly mundane tasks require knowledge and skill, even expertise.[39] Novice teams bump and blunder; experienced teams move gracefully as one. Although my scientist-guide was in his second field season he said it was easy to mess up, rattling off possible errors. He joked that when he first began sampling he often had to restart seven times in a single enclosure. I wasn't sure if he was exaggerating or not.

* * *

Lake Stechlin and the LakeLab are located within a nature reserve, but the now-closed Rheinsberg nuclear power plant sits atop a hillside two kilometers to the west on a tract of land partly within the reserve. Approved in 1956 and operational in 1966, it was East Germany's first nuclear power plant (and the second in either Germany). Given the Cold War the Rheinsberg facility was sited in a densely forested area with low human population.[40] The plant drew four hundred thousand cubic meters of water daily from Lake Nehmitz for cooling, released warmed water into Lake Stechlin, and then pulled water from Lake Stechlin back into Lake Nehmitz. Despite the depth of the glacially created lakes, the release of cooling water raised Lake Stechlin's temperature "on average 10° C above the ordinary level."[41] The reactor's thermal pollution affected the Lake Nehmitz-Stechlin system until the facility closed in 1990.[42] The nuclear power plant

38. Men and women participate in sampling, but I only saw men performing this aspect of the team's work—hence "he."

39. For important perspectives on "skill," see Lerman, "'Preparing for the Duties.'" On the strategic construction of science/nonscience, which applies to expertise and experts, see Gieryn, "Boundary-Work."

40. Casper, *Lake Stechlin*, v, 482; "Rheinsberg Nuclear Power Plant," *Atlas Obscura*, https://www.atlasobscura.com/places/rheinsberg-nuclear-power-plant (accessed December 13, 2021).

41. Casper, *Lake Stechlin*, v, 21; quotation from v.

42. "Rheinsberg Nuclear Power Plant."

was a machine in the forest—indeed partly in a nature reserve—thoroughly integrated with the watershed.[43]

* * *

Those interned at Ravensbrück might have disagreed with historians and the government's Nazi war crimes office, who have classified it as a labor camp. Many called it a death camp or, in the words of survivor and French ethnologist Germaine Tillion, a place of "slow extermination."[44] Yet those women who were murdered on site, sent to Bernburg's "sanatorium," or deported to Auschwitz did not experience Ravensbrück as slow extermination.[45] By outsourcing most killing until the war's final months, Ravensbrück could remain a "labor" camp.

Thirty to ninety thousand of Ravensbrück's 130,000 internees died over its six-year existence. It is not clear whether these figures include those deported to Auschwitz. Historians also suspect that many women sent to Ravensbrück in the war's last months were never recorded in official files. Definite figures will never be known; they are unknowable.

Survivors criticize those obsessed with accurate death counts. In the words of survivor and French doctor Loulou Le Porz, "The Germans were always counting us. Now the academics count us again. Some study us like ants."[46]

Obscurity

I helped sample water during the 2018 field season. Unlike some artificial-light-at-night research, sampling is not limited to the new moon and a few days on either side, when night skies are darkest. Ecologists conduct fieldwork during the entire lunar cycle to capture the range of nighttime light conditions that species and ecosystems experience.

Nonetheless, during my second week sampling happened to take place near the new moon. Clouds moved in overnight, making predawn even darker.[47] I was glad it was my second week there. Previous time on the platform made it easier to navigate the awkward walkways and precarious holes of exposed water. Despite the clouds the red light atop the shuttered Rheinsberg nuclear power plant glowed.

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43. Marx, *Machine in the Garden*. On envirotechnical systems, see Pritchard, *Confluence*; Pritchard, "Envirotechnical Disaster."

44. Helm, *Ravensbrück*, xxii.

45. Helm, *Ravensbrück*, 154–55, 232, 242–43.

46. Helm, *Ravensbrück*, xviii, 639, 650–51; quotation from 651. On the history and (re)production of ignorance, see Proctor and Schiebinger, *Agnotology*.

47. For discussion of night-sky brightness, including the role of clouds at Lake Stechlin, see Jechow et al., "Evaluating the Summer Night." On the impact of clouds on artificial light at night generally, see Kyba et al., "Cloud Coverage Acts"; Jechow et al., "Imaging and Mapping the Impact"; Jechow et al., "Using All-Sky Differential Photometry"; Jechow, Kyba, and Hölker, "Mapping the Brightness."

On February 1, 1959, as the nuclear power plant was being built, the East German government approved a limnology (the scientific study of inland, freshwater aquatic ecosystems) field station on Lake Stechlin's southern shore. After 1966, once the Rheinsberg facility was operational, "the research programme" at the field station "focused on the effect of the influx of the [reactor's] cooling water on the production and energy flow of the whole ecological system of the lake."[48]

The East German government had also established a hydrometeorological station next door. In 1957 this station "was entrusted with hydrometeorological investigations of Lake Stechlin for the purpose of collecting basic data for design, building and operation of a power plant." Presumably it could also predict, measure, and monitor radioactive contamination in case of an accident. Notably a 1965 study tracing the hydrometeorological station's early years referred to the Rheinsberg facility as a "power plant," never a nuclear power plant.[49] If making things nuclear takes work, other work can obscure the "nuclearity" of nuclear things.[50]

Lake Stechlin's limnology field station, now overseen by the Leibniz Institute of Freshwater Ecology and Inland Fisheries outside Berlin, highlights its prominence in long-term ecological monitoring—one of the longest in Germany. This is a reframing of the institution, its original purpose, and its research. Data from the long-term ecological monitoring of Lake Stechlin resulted from the construction of a nuclear power plant and the atomic age more broadly, not basic ecology research. The limnology field station is just one example of the entanglement of ecology with the atomic age.[51] But like "power plant," long-term ecological monitoring obfuscates and denuclearizes the field stations and their history.

* * *

No centralized camp archive existed until 1981. Since then, the Ravensbrück National Memorial has collected fragments of camp files and copies of relevant sources in Germany and abroad. Some survivors wrote memoirs after the war, detailing life—and death—at Ravensbrück. Sarah Helm has identified dozens of survivors across Europe and beyond—conducting oral histories, gathering rare documents, and recovering information about what took place within Ravensbrück's walls.

48. Casper, *Lake Stechlin*, v, 21; quotation from 21. On the atomic age and ecology, see Bocking, "Ecosystems, Ecologists, and the Atom"; Klingle, "Plying Atomic Waters"; Kingsland, *Evolution of Ecology*; Bocking, *Ecologists and Environmental Politics*; DeLoughrey, "Myth of Isolates"; Creager, *Life Atomic*; Martin, "Proving Grounds."

49. Heitmann and Schubert, "Lake Stechlin."

50. Hecht, "Power of Nuclear Things"; Hecht, *Being Nuclear*, introduction.

51. IGB, "Lake Stechlin Monitoring Station," https://www.igb-berlin.de/en/lake-stechlin-monitoring-station (accessed December 13, 2021); IGB, "History of IGB," https://www.igb-berlin.de/en/history-igb (accessed November 9, 2023). On the history of long-term ecological monitoring, see Aronova, Baker, and Oreskes, "Big Science and Big Data"; Zimmerman and Nardi, "Two Approaches to Big Science."

Interminable, 4:00 a.m. roll calls regardless of weather or season.[52]

Thin, tattered clothing, some repurposed from the victims of Auschwitz.

Malnutrition.

Overflowing latrines.

Endless cycles of communicable disease.

Solitary confinement in damp cells without sunlight.

Forced labor at the Siemens factory in Fürstenburg, then factories across German territory.

Medical experiments.[53]

Sterilization.

Forced abortions.

Killing newborns.

Transit to death camps by trains that left the Fürstenburg railroad station where I stood decades later.

Execution.

Suicide.[54]

If the nature reserve is the soil in blood and soil, Ravensbrück—located a dozen kilometers away—is the blood. The Nazi regime had located extermination camps in Eastern Europe to avoid polluting the "pure" soils and waters of Germany. Yet blood spilled at Ravensbrück—first in the slow violence of the labor camp, then in coordinated mass murder during the war's final months.

Nature?

Many researchers in the artificial-light-at-night community refer to "natural" and "pristine" night-sky brightness.[55] Scientists decided to conduct ecological light-pollution experiments at Lake Stechlin in part because its night sky is closer to natural conditions. The area therefore offers a better baseline for experiments.[56] Scientists do not have to worry about disentangling ecological effects from either skyglow or the LakeLab's lighting system.

* * *

Lake Stechlin remained a popular destination for recreation during the Cold War, now for East Germans. The government organized vacations for students and families. By the late 1960s Lake Stechlin became an even hotter tourist hot spot thanks to the nuclear

52. Helm mentions the visibility of stars during roll calls and survivor memories of being too cold to look at them. Helm, *Ravensbrück*, 168.

53. On medical experimentation specifically, see Helm, *Ravensbrück*, 104, 480–81, 515, chaps. 13–14.

54. Helm, *Ravensbrück*; van de Perre, *My Name is Selma*.

55. Duriscoe, "Measuring Anthropogenic Sky Glow"; Falchi et al., "Light Pollution."

56. Jechow et al., "Evaluating the Summer Night."

power plant's thermal pollution. Photographs probably from the early 1980s show packed lakeside beaches and sailboats as far as the eye can see.[57]

After German reunification tourism continued to matter. Thousands of summer tourists still descend on Neuglobsow, Lake Stechlin, and other Lake District villages and lakes. Billboards decorate the streets of Neuglobsow. Idyllic photographs not so different from those taken in the 1980s feature summer recreation. Restaurants, hotels, and, yes, Airbnbs all try to take advantage of the short high season.

* * *

Amid the unrelenting horrors at Ravensbrück, internees found little peace or solace. After building walls around the concentration camp Nazi commanders ordered that they be raised even higher. Those interned could no longer glimpse anything beyond the daunting fortifications; locals could not see in.

Yet survivor Wanda Wojtasik—a teenager in the Polish resistance—remembered decades later, "at least [we] can look up at the stars."[58]

Sediments

During an interview one researcher described how past experiments in the LakeLab's enclosures can shape later ones: "Whatever happened in one enclosure has to be a memory effect for the following experiments." At one point data collected did not match the model he had developed. He and a senior scientist returned to their dog-eared field notebooks. These scientist-historians realized that water in one mesocosm had been mixed in a previous experiment, churning up sediments from the lake bottom within that enclosure. Taking this into account, they reran the model. This time it worked, illustrating the concept of memory effects.

* * *

By early September much of Neuglobsow shuts down. Flyers advertising summer events are faded and torn, flapping in the breeze. Overflow parking lots are empty; only scattered litter is left. Some restaurants are already closed. In the quiet village I see remains of the high season around me.

* * *

In the war's final months the Soviet Army pressed west. Nazi leaders sent internees from concentration camps near Soviet lines to camps farther west, including those on German territory. Few survived death marches to already overcrowded camps. In

57. Casper, *Lake Stechlin*, 477–78.

58. Helm, *Ravensbrück*, 166. In studying survivors' memoirs S. E. Eisterer has found frequent references to the sky and the comfort it brought internees.

January 1945 women were forced to walk six hundred kilometers from Auschwitz to Ravensbrück. Some survived.[59]

With the twin threats of the Soviet Army approaching from the east and US Army from the west, the Nazi regime accelerated killing. In October 1944 Himmler ordered a mass-extermination program at Ravensbrück. Camp commanders converted an old, wooden tool shed into a "small" gas chamber while they built a concrete gas chamber they called the "new washroom." They also constructed mobile gas chambers—described by survivors as a gas van, gas truck, and gas railway carriage—painting them green and placing them in the forest. No one was fooled. Internees called the forest "the little woods of death" [*Todeswäldchen*].[60]

Internees never returned. Survivors recalled seeing flames flickering several meters above the crematorium's chimney. Putrid smoke thickened the air. Ash drifted and settled. Survivors remembered feeling dust in the air and on their skin. "We would turn to each other," Loulou Le Porz recalled, "and say: 'You see they are amongst us again—our comrades.'"

Remaining internees dumped ashes from the crematorium into Lake Schwedt. As Helm writes, "the lake itself [is] a grave." Like other bodies of water, Lake Schwedt became a gruesome archive.[61] Locals began complaining about the ash in the lake. Camp commanders, some of whom came from Auschwitz, thus systematically implemented Nazi extermination policy at Ravensbrück.[62]

Small.

Systematic.

Did windblown ash reach Lake Stechlin and settle to the bottom of the lake? Is it, too, an archive?

Dark Histories

Ecological light-pollution research can be conducted at Lake Stechlin in part thanks to Germany's nighttime lighting norms, which are lower compared to Western European countries such as Belgium and the Netherlands. In other words Germany has a lighter artificial lightprint.[63] This research can also occur because of the Nazi-created nature reserve.

I am still unsure how to narrate the silences around the reserve's history.

Scientists affiliated with the "Illuminating Lake Ecosystems" project and others working at the LakeLab are international. Many researchers are temporary and come

59. Helm, *Ravensbrück*, chap. 32.

60. Helm, *Ravensbrück*, 469–72, 492–98, 503, 553–55, 575, 650; quotation from 498.

61. Rediker, "History from Below"; Boon, "Memories"; Mawani, "Archival Legal History."

62. Helm, *Ravensbrück*, xviii, 439, 451, 550, 564, 650, 653, chaps. 34, 37, 38; quotations from 451 and 650; van de Perre, *My Name is Selma*, 199.

63. For differences in urban lighting in the United States and Germany, see Kyba et al., "High-Resolution Imagery." On the temporality of "lightscapes" see Meier and Henckel, "Urban Lightprints." To my knowledge "lightprint" has not been used elsewhere in publication or as an analytic category.

from countries across Europe and the Americas. Many are junior scholars focused on their professional futures. At the same time, German scientists are disproportionately represented.

Numerous researchers told me about the nature reserve. I don't recall anyone mentioning its Nazi roots. Perhaps they really don't know. I want to give them the benefit of the doubt. As an environmental historian I should have suspected when scientists referred to "the nature reserve." But I didn't make the connection at the time.

When I got home I looked again at the LakeLab website. Under the heading "Nature conservation" it explains that "around Lake Stechlin, there is a long tradition of natural conservation efforts and nature research. The lake has even been under protection since 1938."[64] It then jumps ahead to German reunification.

Still later I perused 2004 and 2022 volumes detailing the reserve's natural history. Both editions barely engage with its political history and only make indirect allusions.[65]

References to the nature reserve and its 1938 founding in multiple contexts hang like emptied signifiers. Silences speak volumes. The reserve is literally and metaphorically dark.

Some prominent tourist information also obscures the area's Nazi past. Billboards in Neuglobsow, Fürstenburg, and the train station highlight the region's landscapes of leisure. One sign on the railroad platform featured fun things to do nearby. It included a map of bike paths leading from Fürstenburg to Neuglobsow and other villages. Finally I saw a reference to the concentration camp and memorial site buried in the lower right-hand corner. The billboard explained that tourists could visit "Ravensbrück." Short text, no photographs or maps, limited information. Another emptied signifier.

Ravensbrück is a site of "dark tourism"—travel to places associated with suffering, tragedy, and death.[66] Largely obfuscated in some tourist information, Ravensbrück has become a doubly dark site. In many ways this obfuscation is surprising, given Germany's active, public engagement with the history and memory of the National Socialist regime.[67] Germans have a typically German word for this—*Vergangenheitsbewältigung*, the process of coming to terms with the past.

Ravensbrück is a dark tourist destination, but the nature reserve is as well—again, literally and metaphorically. Few visitors understand what they are (not) seeing.[68]

I was one of them.

64. IGB, "Lake Stechlin: Nature Conservation," https://www.igb-berlin.de/en/lake-stechlin (accessed November 8, 2023). Of note, the 2022 version of the website included "Nature Conservation" under "LakeLab," rather than "Lake Stechlin."

65. Lütkepohl and Flade, *Das Natueschutzgebiet Stechlin*; Flade, Lütkepohl, and Schrumpf, *Das Naturschutzgebiet Stechlin*. See the addendum on my website for a detailed discussion of these books.

66. On dark tourism see Lennon and Foley, *Dark Tourism*; Stone, "Dark Tourism Scholarship"; Stone et al., *Palgrave Handbook*. For dark tourism at Ravensbrück, see Pastor, *Tourism and Memory*.

67. Studies of history and memory in Germany are too extensive to list here. One classic is LaCapra, *History and Memory after Auschwitz*. Recent overviews include Olick, *Sins of the Fathers*; Pastor, *Tourism and Memory*, chap. 2.

68. On regimes of perceptibility/imperceptibility, see Murphy, *Sick Building Syndrome*.

* * *

As Soviet troops approached Ravensbrück camp commanders burned records as frantically as they murdered the internees. As killing accelerated, document burning slowed and shifted to bonfires. On April 30, 1945, Soviet troops arrived and freed remaining internees. Yet "liberation" entailed its own horrors.[69]

During the Cold War Ravensbrück—the village and the labor camp—fell within East Germany's borders. The government created heroic memorials celebrating Soviet liberation and Communism without referencing its own violent history. Only in the 1990s did historians—German and foreign, led by feminist historians—begin renarrating Ravensbrück's history.[70] Still, limited archival traces remain.

* * *

Layers of darkness cloud Ravensbrück, the nature reserve, and history—and the night skies above them all.

Conclusion

I spent two weeks at Lake Stechlin then headed to Berlin and my flight home. When I left Neuglobsow I got on that bus, saw those signs, walked to the train station, and waited on the platform—increasingly queasy. It was too easy conducting fieldwork at Lake Stechlin—whether scientific or ethnographic—without confronting the area's dark history.

Studying ecological light-pollution research at Lake Stechlin reveals how connections between experiments and environments in the field sciences are much broader and deeper than many contemporary scientists realize. It demonstrates how the discipline of ecology and ecological knowledge itself are products of history. These are not new findings in the environmental humanities or science studies. However, these insights cast scientific research at Lake Stechlin in a new light.

For example, ecologists understand memory effects in terms of natural history. Yet, as environmental historians and others have shown, environments are not natural but naturalcultural. Lake Stechlin has been shaped by glaciers, hydrology, and other environmental processes but also by logging canals, deforestation, nuclear power, and Nazi ideology of blood and soil. Collectively these naturalcultural processes are materialized in the darker night skies above Lake Stechlin. Darkness, too, is naturalcultural.[71]

This essay has shown how darkness is filled with memory and meaning. It has revealed how different kinds of darkness—literal and metaphorical—have been and remain to this day entangled, layered in time and space, across land and lake and sky, cultivating and upholding one another. Histories of Ravensbrück and the nature reserve

69. Helm, *Ravensbrück*, xviii, 568, 577, 585, 613, 630, 650, chap. 41. See also Naimark, *Russians in Germany*.

70. Helm, *Ravensbrück*, xix–xx, 644, 648.

71. So, too, is nocturnal anthropogenic light, such as clouds amplifying skyglow. These ideas are developed in Pritchard, "Night as Environment." On materialization, see Murphy, *Sick Building Syndrome*.

should be told together because their nightscapes are connected.[72] The night sky, scientific research, and ultimate findings are also memory effects of the Nazi regime.

Yet there is a particular irony: many scientists studying artificial light at night do not adequately recognize this dark history. As humanistic scholarship on history and memory has demonstrated, remembering is always also forgetting.[73] What would it mean for these scientists—and many others working in landscapes of violence and oppression—to remember, wrestle with, and acknowledge this history?

Including historical facts, such as who established the nature reserve, is a small first step. But calling for greater reflection means more than tinkering around the edges. Instead I urge scientists and other scholars—all of us, myself included—to contemplate more deeply the complex, fraught landscapes and histories in which we are embedded. Disregarding the past, whether unconsciously or deliberately, can also be dangerous. Reckoning with landscapes and their histories encourages us to contemplate our own worlds with not only a more informed, critical eye but also greater humility. Doing so helps us recognize oppression and injustice in our own times and therefore enables us to cultivate better futures—in science, as in other realms. At least that is my hope.

* * *

As I left the Fürstenberg train station that afternoon I was haunted by Ravensbrück. Since then I have been haunted by the words of Wanda Wojtasik as I think about my time at Lake Stechlin:

at least [we] can look up at the stars.

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Acknowledgments

This research was funded by US National Science Foundation grant no. 1555767. I thank the leadership, scientists, and staff at the IGB, LakeLab, and "Illuminating Lake Ecosystems" project for welcoming me and sharing their research. Thanks also to three anonymous reviewers and the editors of *Environmental Humanities* for their comments on previous versions of this essay.

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72. Both Lütkepohl and Flade, *Das Naturschutzgebiet Stechlin*, 228–29, and Flade, Lütkepohl, and Schrumpf, *Das Naturschutzgebiet Stechlin*, 331, include one paragraph on Ravensbrück.

73. Nora, "Between Memory and History"; Trouillot, *Silencing the Past*.

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