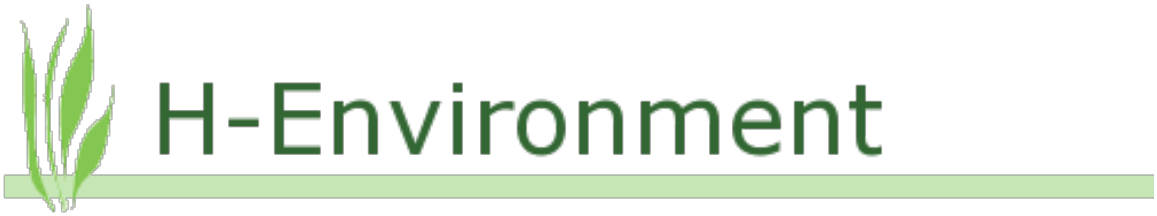

H-Environment Roundtable Reviews

Volume 10, No. 1 (2020)
https://networks.h-net.org/h-environment

Publication date: January 15, 2020
Roundtable Review Editor:
Keith Makoto Woodhouse

Deborah R. Coen, *Climate in Motion: Science, Empire, and the Problem of Scale* (Chicago: University of Chicago Press, 2018). ISBN: 9780226398822

Contents

Introduction by Keith Makoto Woodhouse, Northwestern University

It can be frustrating to study history in this urgent moment. Environmental history, in particular, can seem beside the point as each year brings new and unprecedented climate-related news. Why dwell on what has already taken place when the present demands so much attention and action?

Deborah Coen's *Climate in Motion: Science, Empire, and the Problem of Scale* is a welcome reminder of just how relevant and vital a historical study can be. Coen offers a detailed narrative of climate science in the nineteenth-century Habsburg Monarchy, focusing especially on the history of scaling—of measuring the world in local and global terms and understanding the relationship between them. By looking at how scientists studied a vast and diverse territory both close up and at a remove, Coen considers the ways that Habsburg political structure shaped scientific research and made a virtue of heterogeneity. In its governance and in its state-supported science, the relatively decentralized Habsburg Monarchy understood itself as a land of contrasts defined by "unity in diversity."

It is commonplace now to note the problem of scale as it relates to climate change. A warming planet is at once a matter of national policies and individual habits, of global economic patterns and household budgets, of apportioning land use around the planet and food choices on a dinner plate. These varied decisions can seem incommensurate and unrelated, and "the problem of scale" can be frustratingly abstract. Coen has shown us just how concrete the problem can be, and how we might begin to contend with it. In the Habsburg Monarchy, she writes, "the institutions of imperial-royal science coordinated research across central Europe without imposing a single set of values nor demanding uniform methods" (358). Considering just how Austro-Hungarian scientists struck this balance may help us to navigate the most urgent problem of scale that climate change presents: that decarbonization demands a planetary perspective while social justice requires an understanding of human communities at their most fine-grained.

Daniel Stolz notes the many contributions of *Climate in Motion*, in particular how Coen demonstrates that the nineteenth-century Habsburg Monarchy necessitated a multiscalar conception of a political whole and so provided fertile ground for the emergence of a modern conception of climate, one that integrated the highly specific with the general. As easily as we imagine the state's point of view rendering flat all that is uneven, Coen shows that a varied empire required an appreciation for idiosyncrasy as much as conformity. Taken with Coen's approach and eager to extend it, Stolz considers the differences and similarities between the Austro-Hungarian and Ottoman Empires. Like the Austro-Hungarian, the Ottoman Empire enjoyed state-sponsored scientific institutions that examined a socially and environmentally multifarious land. And the Ottomans often bowed to local knowledge and practices. But faced with nearby adversaries and seeking greater acceptance among European nations, the Ottoman Empire and its scientists, Stolz

explains, had greater cause to emphasize uniformity. Still, Stolz considers several ways in which Coen's rich questions might yield insights for Ottoman historians.

Zozan Pehlivan offers similar praise for Coen's "glocal" approach to the Habsburg Monarchy and suggests that such an approach, applied elsewhere, might release other regions from "the box of nation-state temporal space." Pehlivan also points to how, in Coen's story, scientists spoke to the public as much as to each other and had less investment in a strict divide between experts and amateurs. Was this trend particular to the Habsburg Monarchy, Pehlivan asks, and to the nineteenth century? Did non-Habsburg scientists have a similar commitment to accessibility? And if some nineteenth-century scientists were ready to understand Europe as just one small part of a larger world, why did Eurocentric thought persist in so many other manifestations? Recognizing the contemporary relevance of Coen's work, Pehlivan also asks if Austro-Hungarian scientific practice might offer a model for how contemporary climate scientists could bridge the divide between their work and public opinion.

Like Pehlivan, **Paul Josephson** asks to what degree knowledge circulated not just within but also between imperial regions. And like Stolz, Josephson considers how Coen's framework maps onto other empires—in particular Tsarist Russia and the Soviet Union, both of which encompassed vast and dizzyingly diverse territories. The Soviet Union used science and technology as a means of imperial expansion and cultural assimilation in obvious ways, but all scientific enterprises, Josephson reminds us, reflect social and political agendas. What sort of "extrascientific" pressures might Austro-Hungarian scientists have felt, even if not as acutely as did Soviet scientists? Josephson asks about another empire as well: the modern United States. Given hundreds of U.S. military bases around the world, and Department of Defense studies pointing to the threat posed by climate change, how are we to understand ongoing hostility to climate science in the U.S. even if such science might better serve the interests of an American empire?

Finally, **Peder Anker** notes how *Climate in Motion* uses the question of scale to seamlessly interweave a history of climate science with a history of empire. "How to scale up from local to regional and global knowledge of climate," Anker writes, "involved the social and political power of an empire." Adding to Josephson's reminder about scientific enterprises reflecting political agendas, Anker suggests that such enterprises can serve competing ideologies. The association of environmental research with imperialism is ripe for such service. In the United States the political right might paint environmental studies as a handmaiden of empire, while the political left might view the history of Austro-Hungarian climate science as part and parcel with the history of colonialism. Could the scientific contributions that Coen illuminates encourage sympathy for Austro-Hungarian imperialism? How might we disaggregate a history of collaboration and multiscalar thought from a history of empire? Should we?

In her response, Coen considers and expands upon the various comparisons drawn by Stolz, Pehlivan, and Josephson. And she flips the terms of Anker's provocation: the scientific contributions of the Habsburg Monarchy, she suggests, should not encourage sympathy for imperialism; rather, they should remind us of "the enduring legacies of feudal, capitalist, colonial, and racist hierarchies in today's science." That is a bitter mouthful as we struggle to heed the dire warnings of contemporary climate scientists, but only by digesting it can we confront climate change justly and equitably.

Thanks to all of the roundtable participants for taking part.

Comments by Daniel Stolz, University of Wisconsin-Madison

Scaling the Ottomans: Reflections Inspired by Deborah Coen's *Climate in Motion*

In December 1881, Mahmud Bey al-Falaki submitted a report to his patron, the Khedive of Egypt, recommending the construction of five meteorological stations along the Nile. Like many scientific projects in Egypt in the late nineteenth century, this proposal had both an international and an imperial purpose. Mahmud Bey, who had trained at the Paris Observatory, was fresh from attending the second International Geographical Congress, in Venice. He had promised "the scholars of Europe" that he would work to expand the reach of the observatory sciences in Egypt. Beyond meteorology, other projects that Mahmud Bey promoted during his long career in Egypt included the study of terrestrial magnetism, of solar eclipses, and of the transits of Venus.[1] But each of these globe-spanning enterprises of precision measurement also served a purpose particular to Egypt's own geography, and to the development of the Ottoman-Egyptian state. In the case of meteorology, Mahmud Bey argued before the Khedive that his proposed network of stations would bring modern techniques to bear on a problem that had occupied Egypt's rulers since the Pharaohs: predicting the height of the Nile flood.[2]

Deborah Coen's magisterial new work*, Climate in Motion: Science, Empire, and the Problem of Scale,* is an inspiration to rethink the role of earth sciences, such as meteorology, in the age of high imperialism. For historians of the late Ottoman Empire, to which Khedivial Egypt belonged, this reconsideration might usefully begin with a focus on the relationship between state, knowledge production, and the profound changes that late Ottomans experienced in their political, social, and physical geography. Amid massive population movements (both voluntary and forced), the reorientation of agriculture toward global markets, and new threats ranging from epidemic cholera to ethnonationalist separatism, the late Ottoman state embarked on new ways to gain knowledge of its land and people. While such efforts have received increasing attention from historians, we have tended to interpret late Ottoman environmental, medical, and anthropological sciences as essentially colonizing projects, in which an imperial center sought to impose a uniform order on its peripheries. Coen's contrasting portrait of science in the nineteenth-century Habsburg Empire—a state that bore strong similarities to its southeastern neighbor—calls on us to consider whether the late Ottoman scientific venture might have been less reductive and more nuanced than we think. Put

[1] On Mahmud Bey's career, see Pascal Crozet, "La Trajectoire d'un scientifique égyptien au XIXe siècle: Mahmud al-Falaki (1815-1885)," in *Entre reforme sociale et mouvement national: Identité et modernisation en Égypte* (Cairo: CEDEJ, 1995), 285-309. I have written about Mahmud Bey's astronomical and Egyptological work in Daniel Stolz, *The Lighthouse and the Observatory: Islam, Science, and Empire in Late Ottoman Egypt* (Cambridge, UK: Cambridge University Press, 2018).

[2] "Ifāda wa-maʿhā taqrīr min ḥaḍrat Mahmud Bey al-Falaki bi-shaʾn inshāʾ khamsat raṣadkhānāt biʾl-qaṭar al-Miṣrī," 27 February 1882, Egypt National Archives/Dar al-Wathaʾiq 75-043987.

another way, can we write a history of late Ottoman science in which provincial and local phenomena were not merely problems for the empire to solve, but constitutive of the imperial project itself?

Climate in Motion persuasively argues that a modern conception of climate emerged most powerfully where the ability to think across multiple levels of scale was a political imperative. Not only was the Habsburg Empire a single contiguous land mass with finely variegated and shifting patterns of temperature, rainfall, and wind. It was also an empire that respected, on principle, the concept of local variation and difference. Due in part to the distinctive arrangement of the dual monarchy, Habsburg men of science tended not to think in terms of a single, uniform imperial space. Coen reminds us, "Making territory and its population legible need not mean abstracting away local particularities. 'Seeing like a state' might instead mean bringing imperial diversity into sharper focus" (9). Rather than imposing uniformity, Habsburg science sought to represent heterogeneity.

There are good reasons to think that late Ottoman science might have functioned similarly. In both geographic and sociopolitical terms, the late Ottoman Empire was arguably the Habsburgs' closest parallel. Both were large land empires in an era defined (so we are told) by overseas colonialism. Both included a vast diversity of physical environments, inhabited by a sprawling patchwork of ethnic, religious, and linguistic populations, bound together by a variegated fabric of political relationships. Moreover, as in the Habsburg case, the late Ottoman state was the preeminent patron of science in its lands. Almost all new institutions of scientific training in the nineteenth century were founded and administered by the state, and the state was the most important employer of these institution's graduates. In sum, Habsburg and Ottoman science were each a heavily state-directed enterprise that engaged a vast land empire of breathtaking physical and social heterogeneity.

But did Ottoman science seek to represent the Empire's heterogeneity in the multi-scalar manner that Coen attributes to the Habsburgs? Or should we understand Ottoman science as a contrasting example, in which "seeing like a state" did in fact mean "abstracting away local particularities"? The evidence is mixed.

To some extent, Coen's multi-scalar Habsburg science resembles the "coordinated localism" that Alan Mikhail has shown was characteristic of the Ottoman Empire's approach to resource management during the early modern period.[3] The Ottomans oversaw vital patterns of material circulation in the seventeenth and eighteenth centuries: wood from Anatolian forests went to Suez to build boats that carried Egyptian grain across the Red Sea to the pilgrimage cities in Western Arabia, for example. However, far from imposing a single imperial vision on agricultural labor, the early modern Ottoman state deferred to—because it relied upon—the knowledge and judgment of local groups. Thus, the repair of irrigation canals, while

[3] Alan Mikhail, *Under Osman's Tree: The Ottoman Empire, Egypt, and Environmental History* (Chicago: University of Chicago Press, 2017).

of vital concern to the imperial government, was managed and executed by the peasants who knew the land best, rather than by an imperial learned class.

Inspired by Coen's work, perhaps we can push Mikhail's analysis further and investigate the kinds of knowledge production that emerged from such "coordinated localism." The local or even provincial scale has not been the primary unit of analysis in the literature on early modern Ottoman science. Historians of cartography, for example, have tended to interpret the fluorescence of Ottoman mapmaking in the sixteenth and seventeenth centuries either in terms of an Istanbul-centered imperial project, or as evidence of Ottoman material and intellectual exchange with Europe.[4] (These interpretations are complementary, of course.) We know much less about the development of an imperial knowledge that was rooted in thinking at and across the provincial or local scale, as in Coen's Habsburg case.

For the late Ottoman period, historians have placed even greater emphasis on science as serving the needs of a centralizing imperial vision. Omnia El Shakry, for example, has noted the close relationship between the emergence of the social sciences in Egypt and commitment to the "unity of the Nile Valley," which justified the colonization of the Sudan.[5] I would argue that Mahmud Bey's efforts to build observatories and carry out scientific expeditions in the upper Nile Valley were similarly embedded in the Khedivial dynasty's ambitions in the Sudan and East Africa. Other scholars have shown that Ottoman efforts to build telegraphic networks, to introduce new military and agricultural sciences, and to train a modern medical corps, were all—in part—colonizing projects that benefited the imperial state *at the expense* of regional, provincial, or village actors.[6] Despite the many similarities between the late Ottoman and Habsburg Empires, late Ottoman science appears to have taken a very different path from its Austro-Hungarian counterpart: one that sought to reduce or eliminate, rather than to represent, the empire's heterogeneity.

Such divergent paths emerged from different political realities that lay beneath the two empires' apparent similarities. If the Habsburg and Ottoman polities were both multi-ethnic land empires in an age of rising ethnonationalism, they dealt with this circumstance quite differently. For the Habsburgs, as Coen demonstrates, the

---

[4] M. Pinar Emiralioğlu, "Cartography and Geographical Consciousness in the Ottoman Empire (1453-1730)," in *European Cartographers and the Ottoman World, 1500-1750,* with Ian Manners (Chicago: Oriental Institute, 2007); Palmira Brummett, "Imagining the Early Modern Ottoman Space, from World History to Piri Reis," in *The Early Modern Ottomans: Remapping the Empire*, ed. Virginia H. Aksan and Daniel Goffman (Cambridge, UK: Cambridge University Press, 2007); Giancarlo Casale, *The Ottoman Age of Exploration* (Oxford: Oxford University Press, 2010). For an intriguing study of early modern Ottoman representations of frontier space, see Kathryn A. Ebel, "Representations of the Frontier in Ottoman Town Views of the Sixteenth Century," *Imago Mundi* 60, no. 1 (2008): 1-22.

[5] Omnia El Shakry, *The Great Social Laboratory: Subjects of Knowledge in Colonial and Postcolonial Egypt* (Stanford, CA: Stanford University Press, 2007).

[6] See, e.g., Mostafa Minawi, "Telegraphs and Territoriality in Ottoman Africa and Arabia during the Age of High Imperialism," *Journal of Balkan and Near Eastern Studies* 18, no. 6 (2016): 567-587.

"Austrian Idea" sought to diminish the appeal of nationalism by emphasizing the benefits of heterogeneity. In economic terms, due to the enduring influence of cameralist thought in Austria-Hungary, the Empire's environmental diversity was understood to lend itself to economic self-sufficiency. Meanwhile, in social and cultural terms, the Habsburg lands were said to be so diverse as to lack the critical mass for nationalist movements to coalesce. Thus, Coen writes, "in an era when nationalism was reconceiving historical research as a quest for authenticity and indigeneity, a largely forgotten [Habsburg] project emerged across the human and natural sciences to focus attention instead on the complexity of cultural flows" (51).

For the late Ottomans, by contrast, such a project would have seemed full of peril. For not only did the Empire face powerful adversaries, imperial Russia above all, who were determined to fan the flames of nationalism on multiple frontiers. As Selim Deringil has shown, late Ottoman efforts at self-representation and legitimation also had to tread carefully around the politics of Orientalism.[7] Anything that might tend to exoticize the Ottoman lands would have confounded the Ottoman quest to win acceptance as full-fledged members of the European concert. In this context, the guardians of the late Ottoman state, from the reforming ministers of the Tanzimat era to the "Young Turks" who seized power in 1908, tended to see the Empire's heterogeneity as a mortal danger, rather than a resource to be cultivated. It stands to reason that late Ottoman science may accordingly have deemphasized—or actively repressed—the kind of multi-scalar approach that Coen finds to have been endemic to Habsburg science in the same period.

But perhaps there are alternative stories to tell here as well. Recent scholarship has explored how the demographic and economic changes of the nineteenth century stimulated Ottoman efforts to manage specific environments. For example, the migration of populations from the Empire's lost territories, alongside Ottoman efforts to "settle" (*iskân*) pastoral groups, prompted an intensification of settlement in the Mediterranean lowlands. In this context, the encounter with malaria—understood as an environmental problem—made swamp drainage a central concern for key provincial administrators and statesmen.[8] As with Mikhail's early modern "coordinated localism," however, there remains a gap between the portrait that environmental historians have drawn of a multi-scalar Ottoman statecraft, and the emphasis on a homogenizing imperial center that emerges from the history of science literature. It is worth asking, how did knowledge that was particular to a specific regional scale—such as the marshes of the Mediterranean lowlands—inform a larger scientific project that was committed to maintaining the empire yet irreducibly local in its vision of what that empire comprised? A narrative that addressed this question would offer an understanding of the Ottoman Empire's crucial last decades that moves beyond the paradigm of a centralizing imperial

[7] Selim Deringil, *The Well-Protected Domains: Ideology and the Legitimation of Power in the Ottoman Empire, 1876-1909* (London: I.B. Tauris, 1998).
[8] Chris Gratien, "The Ottoman Quagmire: Malaria, Swamps, and Settlement in the Late Ottoman Mediterranean," *IJMES* 49 (2017): 583-604.

administration at war with its provinces, considering instead how the "imperial" was made through engagement with its specific regional and local geographies.[9]

Understanding how the late Ottomans "scaled" their empire could also shed light on broader political questions. For example, over the last decade, Egypt has been embroiled in a complex controversy with Ethiopia regarding the latter country's plans for the Grand Renaissance Dam (formerly the Millennium Dam). The controversy is one of many to illuminate the inadequacy of the nation-state as a unit of scale for solving problems of water provisioning. Yet Egypt's leaders since 1952 have embraced a nationalist water politics, grounded in the monumental foundation of the High Dam at Aswan, by means of which Cairo was supposed to be able to control the river from inside Egypt's national borders. But other visions were once considered. The summer after Mahmud Bey presented his meteorological proposal, British forces occupied Egypt and introduced an informal colonial administration that rendered the Khedive's lands—still under Ottoman sovereignty—effectively a part of the British Empire. Their understanding of the river system flowed not only from the "overseas" empire that was ruled from Whitehall, but also from a long history of Ottoman and Ottoman-Egyptian efforts—the work of people like Mahmud Bey. The Nile masterplan that emerged from Egypt's colonial period placed the management of the river within a system of dams and canals reaching deep into East and Central Africa.[10] Technical as well as political challenges hindered the realization of this plan, and I am by no means suggesting a return to the colonial past as a cure for the ills of the nationalist present. But the Grand Renaissance Dam is one more reminder that the problem of building an ecologically sustainable society is in part a problem of the scale at which politics, including environmental politics, came to function in the twentieth century. Coen's book is a necessary reminder that alternative ways of scaling science and politics belong not only to a dimly imagined future, but were in fact the norm for many people, for many years, and not long ago.

---

[9] For an example of such a perspective on late Ottoman legal history, see Nora Barakat, *An Empty Land? Nomads and Property Administration in Hamidian Syria* (PhD Diss., University of California-Berkeley, 2015).

[10] On the Century Storage Scheme, see John Waterbury, *Hydropolitics of the Nile Valley* (Syracuse, NY: Syracuse University Press, 1979), 89-96.

Comments by Zozan Pehlivan, University of Minnesota-Twin Cities

Making Empire by Making Science

Climate in Motion: Science, Empire, and the Problem of Scale is an intertwined history that explores the processes through which empire and modern science came into being. In the context of the Habsburg empire, Deborah Coen shows how environmental science became a useful apparatus that helped hold together a multiethnic monarchy in the age of nationalism, tracing "the mutual development of imperial ideology and empire-wide institutions of environmental science" (20) from the 1850s to 1925. This was a period that followed large territorial losses in which political efforts were directed to maintain a multi-ethnic, multi-linguistic, and multi-religious monarchy. As this work shows, at this juncture, geography, botany, and other environmental sciences, forms of knowledge which could map the physical and natural features of a territory, were employed to promote the idea of unity between the remaining imperial territories. In this regard, atlases, maps, and newspapers became important tools to teach the public about the diverse environment of the empire they belonged to, while provincial museums and botanical gardens became spaces in which ordinary subjects could experience this nature firsthand. As a contribution to the field of global environmental history, this book represents an insightful account that helps us understand the development of modern climate science, and the role of imperial investment in this story. In doing so it asks new questions that will surely stimulate those working in the field.

Climate in Motion shows how the physical space of Habsburg monarchy and its diverse character were investigated by both intellectuals and bureaucrats, motivated by a combination of economic, political, and scholarly interests. As these geographers, physicists, and botanists travelled across this region, mostly supported by provincial and central government, they observed, examined, and most importantly classified everything they found. From soil types to rocks, from wild flowers in the river valleys to grasses in the Hungarian steppes, from gentle breezes to strong winds in the Alpine mountains, every "small thing" became a source of scientific inquiry to be investigated. In turn, these state researchers and scientists working in laboratories had to keep their patronage networks alive to sustain funding and support for their scientific research. It was this interdependent relationship that produced a new title in the research fields of environmental science, the "imperial-royal scientist" (64).

Diversity in landscape, climate, flora, and fauna were perceived as features that unified the monarchy's lands. Coen calls this "unity in diversity", a major theme in *Climate in Motion*. The findings of these geographers, physicists, and botanists were presented not only to academic communities in observatories, universities, state-sponsored centers, institutes, museums, and botanical gardens, but also to the public through the tools of print capitalism, newspapers, maps, and atlases. Knowing geography, soil, and natural resources and how these resources could be

exploited, in turn, helped construct the idea of the "expert", a figure that imbibed authority and power. Thus, the ability to portray the empire, a spatial unit with multiple economic resources located in different ecological zones, became a crucial part of the development of environmental sciences in the late century. Diversity was making "Austria great" and it became the duty of geographers, physicists, climatologists, and travelers to characterize each region's particularities. Observation, the basis of empirical knowledge, became the most common and applicable method with which to learn and characterize each territory and the interaction among territories of the empire.

The figure of the 'expert' remains central throughout this study, and we are given insight into various imperial-royal scientists' stories which examine their motivations. On one hand, the rise of these royal-scientists with their strong ties to the central and provincial governments or polities provided infrastructure for scientists to travel efficiently for research trips, making observations and storing their findings from "field sciences" in state-sponsored store-houses. *Climate in Motion* shows us that what was important and useful for late imperial politics was this "emerging sense of monarchy as a geographic unit" for the first time (78). Of note are references to the ways ordinary people interacted with this process—the teachers, doctors, civil servants and others, who voluntarily made atmospheric and climactic observations where they lived or worked, and then shared their findings with these royal-scientists in Vienna. Coen describes this development richly but not exhaustively. Giving more of a voice to ordinary people, knowing more of the rationale behind their participation, would have provided an extremely compelling addition to this volume. It would certainly make for a worthwhile future project. Global environmental history stands to benefit immensely from knowing more about how ordinary people have responded to both environmental changes, and environmental science, at the local level.

The *problem of scale* is the other major theme in *Climate in Motion*. Coen describes how these imperial-royal scientists focused on "small things" while not losing interest in the bigger picture. By using climatography to make "local-global interactions and patterns of change" noticeable, imperial-royal scientists stressed their importance within an "imperial and cosmic order" (146). They argued that, as a dynamic phenomenon, local climate could "only" be understood in relation to global circulation of energies in the atmosphere. This approach, Coen argues, brought a new paradigm to the history of climate science, *dynamic climatology*. In this view, climate was not static; like nature, it changed over time. The change in the climate was the product of interactions that occurred between local and global forces. Having such an understanding is extremely important for environmental historians who are especially interested in the origins and factors directing regional climatic anomalies. Employing a *glocal* approach without losing attention to the local particularities would shed light on some regions of the globe whose histories have been imprisoned in the box of nation-state temporal space.

The last two chapters—"The Floral Archive" and "Landscapes of Desire"—in my opinion offer the most significant interventions. These include sensitive portrayals of the intellectual journey of some of the imperial-royal scientists, including Julius Hann and Anton Kerner, revealing their personal crises, modernist prejudices, and changes they underwent through their research. In Kerner's journey, Coen shows how botany became the most useful instrument in the hands of scientists to trace climate change and to expound it to the public. Living plants worked "to bridge the temporal scales of human history and geohistory" and were "climatic indicators that spoke to nearly all the senses at once" (274). Here again, imperial-royal scientists built a bridge with the public by teaching "scientists and non-scientists alike." There was not the intellectual elitism or "seclusion" that is very common in contemporary science. Was this approach only followed by royal-imperial scientists or was it part of a global trend? If it was a global trend, what does it tell us about the intellectual and cultural history of the nineteenth century? More importantly, by looking at the collaboration between scientists and the public in the nineteenth and early twentieth century, can we reconsider the ways in which relationships between scientists and ordinary citizens have evolved to deal with the problem of climate change in recent times? Here, the utility of interdisciplinary approaches is made most clear, allowing the author to offer insights into one of the most unavoidable crises currently affecting the history of our planet. In learning about these earlier issues, we are given important context for these contemporary problems.

In "Landscapes of Desire," Coen's training as a historian of science comes to the fore. Julius Hann's personal diaries become one of the major historical sources through which to perceive his personal and intellectual journey, from a homesick youth to a royal-imperial scientist, whose mind and heart was suspended between a constant longing for his homeland and a growing desire to know the "foreign." The contrast between these two emotions became the driving force of his curiosity, directed "to the science of atmosphere to orient himself in a wide world." The relationship between "home", which later would be the monarchy, and the "foreign," the globe, informed his understanding of *scale*. The monarchy as whole was only a "microcosm of wider world" (321). By recording distant weather events in his diaries, Hann was able to identify correlations between "weather patterns across great distances" that let him to notice global teleconnections, which later would be known as the North Atlantic Oscillation. According to Hann, a "new sense of proportion" would rescue us from "provinciality" of European climatology in the nineteenth century. Europe was a "small piece of a much-larger-puzzle" (324). It is crystal clear that Hann implemented a global approach to climate science and his approach influenced the direction of environmental sciences. If the climate of Europe was only a small piece in the larger puzzle of global atmospheric circulation, why was not its history, power, and intellect? Why did it take more than a hundred years following Hann's research for historians or other social scientists to notice global interactions and changes that came out of this process? We may want to ask ourselves why "provincializing Europe" in the atmospheric circulation was less difficult for Hann but seemingly considerably harder for social scientists in the twentieth century. Were imperial-royal scientists more open minded than today's social scientists?

Compared to other empires, what seems distinctive to the Austrian case is the number and form of the participants—including many amateurs besides imperial-royal scientists—as well as the modes through which knowledge was transferred to the public. Coen describes this process as evidence showing "engagement of public to science" that contained "no seclusion" (99). However, it is worth noting that many of the ideas examined here speak to processes we can locate operating beyond the monograph's geographic interest, and would act as rich grounds for future comparative study. If, for instance, multiplicity in flora and fauna was acknowledged as "Austria's celebrated diversity", in the Ottoman Empire we can find the celebration of a diversity rooted between nomads and other ethno-linguistic communities and the different environments they inhabited. Sultan Abdulhamid II's (1876-1908) photograph albums portrayed peoples, landscapes, mines, harbors and even animals, particularly horses, from across the varied geographies of this empire. These attempted to connect the Anatolian steppes to the marshes of

Iraq, the mountains of Lebanon to the islands in the Mediterranean Sea. If the tools were different the *motion* was the same, and Coen's *unity of diversity* helps us capture this. It is noteworthy that these photograph albums were even presented to Otto van Bismarck in 1886, showing the Ottoman Empire's diverse geographies and cultures to Europe. Other examples include the ways in which scientists began to see different landscapes, those that had previously been portrayed as "wasteland" in particular. In the nineteenth century, these lands were identified similarly across the empires. In Ottoman Empire, for example, mostly civil servants were employed to do surveys in semi-arid zones also known as wasteland or the desert, and we can find similar examples in the British Empire.

In what is testament to the thought-provoking nature of this book, I was inspired to reconsider the archives I most regularly use. In doing so I found that almost three hundred years after Takiyüddin's observatory in Constantinople burnt down, mathematician and physicist Aristide Coumbary, a Greek subject of the empire and the first Director of the Imperial Meteorological Observatory at Constantinople, submitted one of his first petitions to the Ministry of Public Works. He sought permission to build an observatory in the empire's capital that he hoped would operate in close communication with other existing observatories in Paris, Vienna, and Rome. In his petition, dated 6 June 1868, Coumbary highlighted two main points in his attempt to gain the Sultan's support for this project.[1] First, that the establishment of an observatory in Constantinople would be an extremely useful way to predict whirlwinds and storms. Second, given the city's geographic location connecting Asia with Europe and Black Sea to the Mediterranean, this would turn the city into a center for meteorological science in Europe. The result of a few minutes of research not only gave me an idea for a future research project, but also revealed the level of Ottoman interest in climate science. Although the amount of investment and the number of participants may have differed, there was a

[1] Prime Ministry Archive – Istanbul (BOA), İ. DH. 578/40243, 6 June 1868.

considerable interest in meteorological events and the interactions between these events and their timings in the capital cities of these empires. The presence of such common interests across empires is a crucial point for the history of global environmental sciences, and it will surely not be the last provoked by this important work.

Comments by Paul Josephson, Colby College, MIFI, and Tomsk State University

Austro-Hungarian Lessons for Twentieth Century Empires?

We think about climate, what it means, of what it consists, and the sciences that undergird the study of climate change so frequently today that it is challenging to recall that climatology remains in many ways a modern field. In *Climate in Motion* Deborah Coen explores the genesis of climatology in the Austro-Hungarian Empire. Coen argues, in essence, that scientists in a variety of state-sponsored institutions, notably the recently founded Central Institute for Meteorology and Earth Dynamics (ZAMG), engaged climate study in support of empire building in the Austro-Hungarian Empire from roughly 1850 to 1918.

Through close examination of the work of such scientists as the meteorologist Julius Hann, geographer Alexander Supan, botanist Anton Kerner, and others in a variety of fields, Coen demonstrates that the state supported meteorology and the climate sciences in part as a way to link the multinational empire of at least ten language groups that included Austria; Hungary and parts of Czech Republic and Slovakia; Poland; Italy; and Romania. The fields included hydrodynamics, plant geography, botany, meteorology, and topography. Out of the scientific work came a variety of important studies on—and debates about—environmental change, its scales from microclimate to global range, whether it was cyclical, and the role of human action in it. Through their scientific research, these scholars helped bring together territories and peoples from the Alps to the European steppe. At first studying on small scales, in part in order to overcome a paucity of data, they linked their work across their empire in ever-larger tomes and extensive maps. Imperial science indeed served, tautologically, the empire. At the same time, the scientists engaged in a kind of early scientific popularization, both through their institutions, and universities, museums, and publishing houses to develop and share scientific knowledge about the way the climate and weather somehow united the Austro-Hungarian Empire and its peoples. This is a thoroughly researched and engaging study, meticulous in detail and broad in use of a variety of sources from the sciences, literature, botany, art and politics.

Of course, climate change discourse a century ago was much different from that of today when it has become so obviously politicized. But perhaps we can learn from Coen's study to speculate beyond the scales of the Austro-Hungarian Empire, beyond the interwar years of her last chapter, into the late twentieth century, and into other notions of empire, scale and the politics of science. I have in mind consideration of the one empire I know well, Tsarist Russia and the former Soviet Union, an empire also of diverse climates and ethnicities (over 100 language groups!), of extensive research on climate and ecosystems, and a place of notorious politicization of science. Although Russian/Soviet contributions to climate science

have been undervalued and belatedly recognized, there is a rich literature on this field.[1]

Several observations seem pertinent: it is widely recognized how the Soviet Union embraced science and technology as engines of empire building, if focused largely and often on military expansion and economic rebuilding, and also as a tool of cultural construction, hence with a much more applied emphasis than seems present in the case of the Austro-Hungarian empire. That is, the Soviets used nascent climate science as one of many tools not only to incorporate ethnic minorities and their regions into the empire, but also to put natural resources in the service of Moscow. What kinds of applications resulted from the work of the Austro-Hungarian specialists in the employ of the state?

As for imperial regimes, both Russia and the Austro-Hungarian empires were continental, and possessed a diversity of environments. The Russian empire stretched from the European plain to the Pacific Ocean, and from Arctic to desert climates, with vast forest and steppe regions. As Coen indicates, the vast if collapsing Austro-Hungarian Empire also consisted of a wide variety of ecosystems, regions, climates and the like. Did scientists in the Russian empire face the same challenges of data gathering and accumulation as their counterparts in Europe (perhaps even more so), and not simply because of the expanse of the Tsarist/Soviet empires, low population densities, and frigid continental climates, but because the poor support for research on science on the periphery until the late Stalin era? Specialists struggled into mid-century to gather information on temperature, pressure, river flow and its seasonality, winds, ocean currents, and so on, with few stations, and fewer still radio-automated meters.

The debates and concerns of specialists in Tsarist Russia and the Austro-Hungarian Empire seem quite alike, as David Moon, Jane Costlow and others note. Moon, for example, points out how Russian society, like its European counterparts, debated extensively the nature and essence of climate change, whether it was cyclical or

---

[1] Regarding Russian studies of climate change, it would be best to consider the work of the following authors, for each of whom here I cite only one work: David Moon (who works on the ecology of the steppe), Stephen Brain (who has written about forestry and nature transformation), Jane Costlow (who writes about forests, water and culture in the Russian world), Pei Yi-Chu (who is working on the development of the concept of "permafrost"), Andy Bruno (who writes about Arctic environments and climate studies), Jonathan Oldfield (who has written about Soviet contributions to the science of anthropogenic climate change). See Jonathan Oldfield, "Imagining climates past, present and future: Soviet contributions to the science of anthropogenic climate change, 1953-1991," *Journal of Historical Geography* 60 (April 2018), 41-51; Stephen Brain, *Song of the Forest: Russian Forestry and Stalin's Environmentalism*, (Pittsburgh, PA: University of Pittsburgh Press, 2011); Jane Costlow, *Heart-Pine Russia: Walking and Writing the Nineteenth-Century Forest* (Ithaca: Cornell University Press, 2013); Chu, Pey-Yi. "Mapping Permafrost Country: Creating an Environmental Object in the Soviet Union, 1920s–1940s." *Environmental History* 20, no. 3 (July 2015), 396–421; Andy Bruno, *The Nature of Soviet Power: An Arctic Environmental History* (Cambridge: Cambridge University Press, 2016); and David Moon, "The Debate over Climate Change in the Steppe Region in Nineteenth-Century Russia," *Russian Review* 69, no. 2 (April 2010), 251-275.

progressive, becoming more extreme, had anthropogenic roots, and what the impacts might be on the crucial agricultural sector. He cites the broad social response to fears of "desiccation"—deforestation leading to climate change, drier climate and frequent, more extensive droughts, and so on. Moon writes, "In spite of the recurring droughts in the steppe region, and the catastrophic drought, crop failure, and famine of 1891-92, Russian scientists were part of this wider trend away from understanding climate change as progressive and anthropogenic, and toward the idea that it was cyclical and autogenic."[2] Such major early contributors to climatology as the soil scientist Vasilii Dokuchaev and the meteorologist Aleksandr Voeikov clearly knew of the work of their European counterparts. How much exchange and circulation of knowledge was there among world specialists in the second half of the nineteenth century and how did this contribute to climate science?

Coen addresses the popularizing activities of climate specialists. In Russia and the USSR, as James Andrews[3] and others have shown, popularization was not a happenstance thing, but a nationally-sponsored effort to show how science and technology were being put to use for the building of the state, its military and economic power, and securing the welfare of the worker, a burgeoning effort that exploded in the postwar years. Was any of the effort in the Austro-Hungarian Empire state-sponsored, or did it rely primarily on the scientists' own activities?

Coen shows how the growth of institutions was crucial to the nascent science. A parallel Soviet institute to ZAMG was the Arctic and Antarctic Research Institute that, from quite modest beginnings in the 1930s by the 1950s had regularized its extensive atmospheric and oceanographic research program. Its specialists built and operated, at great cost, a series of floating Arctic research stations, with scientists occupying ice fields for months and years at a time. From 1948 (station "North-2") through 2009-10 (SP-37) the USSR launched and maintained a virtually constant presence in the arctic on 94 drift stations with a total time of 31,680 days with a total distance of 183,450 kilometers, in which 2,111 researchers participated.[4] These stations—and many others—carried out oceanographic, meteorological, magnetic, and ionospheric observations by the hundreds of thousands. They learned about water exchange, relief, the ocean floor, and microbiology, at last overcoming the paucity of data.[5] In turn, the Soviet government used this science as part of the effort to impose a Cartesian grid of understanding on the Arctic in part to claim it as Russia's own, and to incorporate, by force if necessary as "backwards" people, the

[2] Moon, "The Debate over Climate Change."
[3] James Andrews, *Science for the Masses: The Bolshevik State, Public Science, and the Popular Imagination in Soviet Russia, 1917-1934* (College Station: Texas A and M Press, 2003).
[4] A. O. Andreev, M. V. Dukal'skaia, S. V. Frolov, "Stranitsy istorii AANII," *Problemy Arktiki i Antarktiki*, no. 1 (84), 2010, 14-16.
[5] A.F. Treshnikov, "Ordena Lenin Arkticheskomu i Antarkticheskomu Nauchno-Issledovatel'skomu Institutu – 50 let," *Problemy Arktiki i Antarktiki*, 36-37 (1970), 16-17.

minority ethnicities spread across the tundra and taiga.[6] Toward what ends and how did state leaders employ the science of Supan, Kerner, and the meteorologist and physicist Felix Exner?

And what of the Austro-Hungarian emperor? How did the emperor and his court politicize science if at all? How did they make it a symbol of the great culture over which they presided? In the USSR, climate studies, expeditions, and "conquests" were explicitly politicized, and made a part of cultural, civilizing and economic programs. The Bolsheviks established an entire administration, almost an empire to itself, responsible for securing Arctic resources and borders known as *Glavsevmorput'*.[7] While specialists in the field sought data, bosses in the Kremlin sought economic achievements. Those researching in tundra and forests, in Arctic and sub-arctic regions, knew first hand that natural conditions limited their abilities to meet plan targets. But in the Stalin years, if they failed to perform as ordered, they might be accused of "wrecking." In one case, after a forestry operation managed to float 7,000 m^3 of lumber down a river in 1932, Moscow ordered it to quintuple the spring float to 35,000 m^3 in 1934, not understanding that a river cannot simply follow Stalin's orders.[8] Climatology, geology, oceanography and other fields continue to serve the Russian empire into the twenty-first century as part of the effort of the government to increase its claims on Arctic resources and justify its growing military presence north of the Arctic Circle. In other words, what was the nature of "extrascientific" pressure on scholars in Vienna and Budapest—those founders of climatology at the service of the state?

Of course, the increasingly grotesque politicization of climatology in the twenty-first century is there for everyone to see, and so what of the meaning of Coen's work for contemporary history and politics? What of the battle against the conclusions of climate science on behalf of the fossil fuel industry by corporations and nations whose leaders think that the future of society rests on burning hydrocarbons? What of the withdrawal of funding for researchers who study climatology? The Trump administration, for example, simply rejects climate science and hopes to eliminate funding for it within federal bureaucracies, or sharply to curtail the scope and approaches of scientific research.[9] To talk about scale: the US Department of Defense has some 800 military bases in 70 countries around the globe, many of them geared toward keeping oil flowing to markets at home. According to its required annual assessment of 2019, there have been dangerous and measurable

---

[6] On the Soviet nationality policy and its development with respect to northern peoples, see Yuri Slezkine *Arctic Mirrors* (Ithaca: Cornell University Press, 1996).
[7] On Glavsevmorput, see John McCannon, *Red Arctic* (Oxford: Oxford University Press, 1998).
[8] State Archive of Arkhangelsk Region (GAAO Otdel DSPI), F. 290, op. 2, d. 549.
[9] Carol Davenport and Mark Landler, "Trump Administration Hardens Its Attack on Climate Science," *New York Times*, May 2, 2019, at https://www.nytimes.com/2019/05/27/us/politics/trump-climate-science.html?fallback=0&recId=1LqkOcgozB9lhFI4SGstVTcH0a0&locked=0&geoContinent=EU&geoRegion=B&recAlloc=top_conversion&geoCountry=ES&blockId=most-popular&imp_id=739657562&action=click&module=trending&pgtype=Article&region=Footer

impacts on DoD "missions, operational plans, and installations," including increased risks of flood, drought and wildfires.[10] Does this not call for support for research in the name of the empire? As historians of science and technology, we all understand that science reflects broader social, political, and cultural values and concerns. We see that empires, even contemporary empires, rely on the scientific enterprise for reasons of public health, military power, economic security and so on. So I suppose I am asking seriously, What would Franz Josef I have done if faced with the DoD report? More generally, how might Coen explain the great hostility to climate science in some circles in the twenty-first century?

[10] John Conger, New Pentagon Report: "The effects of a changing climate are a national security issue," *Center for Climate and Security*, at https://climateandsecurity.org/2019/01/18/new-pentagon-report-the-effects-of-a-changing-climate-are-a-national-security-issue/. See also Office of the Under Secretary of Defense for Acquisition and Sustainment, *Report on Effects of a Changing Climate to the Department of Defense* (Washington: DOD, January 2019)

Comments by Peder Anker, New York University

This book situates the history of climate sciences within the Austrian Empire, tracing the ways in which climate is conceptualized back to this period of central European science politics. It builds on extensive research in Germanic archives, and it is an impressive book in terms of its details and how they support an overall argument. I finished reading the book with a "wow!"

Deborah R. Coen should be known to readers of *H-Environment* as a leading historian of Austrian science and the Habsburg Monarchy, having previously published *Vienna in the Age of Uncertainty* (University of Chicago Press, 2007), but also a path breaking book about the history of (mostly) European disaster sciences in *The Earthquake Observers* (University of Chicago Press, 2013). In *Climate in Motion,* Coen builds on both books by situating the emergence of climatology and metrology within 19th century European history of science.

Climate in Motion reminded me of the importance of German scientific literature of the 19th century. German was the chief scientific language of the time, or, at least, of equal par to English and French. Coen is providing a social history of science by following research money and academic power of the period, which places the Habsburg Monarchy in the middle of things. Given the political and cultural importance of the Habsburgs, it is no huge surprise, perhaps, that their scientists played such an important role in framing the heritage of our climate debates. Yet the book is entirely original and an important reminder of their role, especially as many historians of science have been focusing almost exclusively on the Anglo-Saxon history of climate research.

Yet what really caught my attention when reading *Climate in Motion* was Coen's argument about scale. Local weather is something we are all keenly aware of. While I'm writing this review there is a sweltering heat wave in New York City, and from that I can assume that it's also warm in New Jersey and Long Island. But how do you move from claims about local to regional, national and global weather? It took an empire, Coen shows, an Austrian Empire that is, to think across territorial scales by moving beyond the local with respect to understanding climate. We owe to the Habsburg scientists the understanding that the experience of warm weather at one place is related to the Earth's atmospheric conditions. How to scale up from local to regional and global knowledge of climate involved the social and political power of an empire.

The heritage of our climate debate is all too often described as being the result of the discoveries and insights of individual climate geniuses. In Wikipedia pages as well as in more scholarly books on the discovery of global warming, it seems like our current climate debate is the result of three scientists, namely John Tyndall, Guy Stewart Callendar, and Charles David Keeling. That, of course, is not the case, and Coen's book tells us of the importance of the collective efforts of scientific

communities. This is another key insight from *Climate in Motion*. The detailed account of scientists, with their weather stations, collections of data, and organization of data in Austrian territorial maps, is illuminating.

Coen is, of course, not the only historian of science focusing on the collective enterprise of climate scientists. She is describing the emergence of a longer tradition of multinational thinking about the scale of climate and metrological research. Robert Freedman's book *Appropriating the Weather: Vilhelm Bjerknes and the Construction of a Modern Meteorology* (Cornell University Press, 1993) comes to mind as a book describing some subsequent events. And Rachel E. Rothschild is describing climate research leading up to European climatic pollution maps of the 1970s in her new book *Poisonous Skies: Acid Rain and the Globalization of Pollution* (Chicago University Press, 2019). In this account, acid precipitation maps of both East and West European countries were the result of extensive scientific collaborations. An account of more recent events can be found in Paul N. Edwards' fascinating book *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming* (MIT, 2013) which describes how computer models and climate data built and collected by thousands of scientists resulted in knowledge about climatic change. These are just some titles capturing the collective effort of climate scientists that brought us to where we are today. Coen is keenly aware of this larger story, and has situated her book so as to provide a deeper history of how the problem of scale in climatology was resolved.

All good books raise issues (or 'summer clouds" to use a weather metaphor) worth pondering, and for me that is how to situate this book within current academic politics. Coen, it is worth mentioning, wrote her book as a professor at Columbia University and then Yale University, and *Climate and Motion* is thus written primarily for an academic audience. The book is published by an American press, which raises the question of how to situate it in the divided political culture of the United States.

As readers of *H-Environment* are well aware, many Republicans are skeptical about climate research and some—including the President—even doubt its accuracy and relevance. If the best of climatology emerged from imperialism, they could argue, so much the worse for climate research. I have been exposed to this line argument myself in lieu of my own writings about the legacy of the British Empire for ecological debates in *Imperial Ecology* (Harvard, 2001). I once got a phone call from Fox News asking if I would like to be on their program talking about the evil imperial science of ecology. Ecology and imperialism was, they argued, a perfect theme for the Fox News audience. I have no doubt Coen would have been equally upset if climate change denying journalists sought to use *Climate in Motion* to link climate politics to imperialism. Yet her book raises the question of whether or not the Austrian Empire is a suitable backdrop to promote or even debate our current climate crisis. Coen has written two books inspired by the Habsburg scientists. After these two fascinating and well argued books about the importance of this imperial

legacy, I can't help wondering if we as historians of science and the environment are supposed to be sympathetic to imperial Austrians.

The left leaning Democratic side of the great American political divide is most definitely not sympathetic to imperialism. How do we place Coen's book within the left's current call to decolonize academia by focusing on the Global South, identity politics, immigration, and people of color? This academic movement has raised an important and productive debate about whose history historians should tell. At New York University, where I am teaching, everything European is now looked at with suspicion, especially histories about white European men. And Coen's history of the Austrian science elite would most definitely fall in the category of being yet another book about white men with privilege. So I wonder what the decolonizing of academia movement will do to *Climate in Motion* and the ways in which Coen situates the history of climate research. To be sure, it is unfair to single out Coen's book, as there are libraries of books in European history that would have to answer the same question. Yet this is exactly what is happening now. Libraries of historical research are being questioned in the spirit of decolonization and identity politics. How to respond?

In Europe the politics of knowledge is different. In lieu of Brexit, adherents of the European Union are eager to showcase collaboration across cultural, ethnic, national and linguistic divides. *Climate in Motion* would be a welcomed read in that political context, especially among liberal leaning scientists and activists ready to endorse a legacy of partnership to address shared environmental issues. The problem of scale of the climate crisis is real, and *Climate in Motion* should inspire all those willing to cross all sorts of divides to address it.

To be clear, I do not believe that a fondness for imperialism is what motivated Coen to write this book, but instead that she may have found the Austrians' call for scientific internationalism and culture of collaboration inspiring. Nor do I think this book has an explicit stake in identity politics, as it focuses on commonality and not difference when describing people and events. In parallel, it is a book about climate uniformity and not diversity. As such, the book tells a story to the liking of the socio-political culture of the moderate European left. It should also stimulate the many climate scientists and activists all over the world seeking to overcome our differences through international collaboration. At least, it was this aspiration in the book I found most moving. Yet the question remains: will it provoke or inspire a divided American audience?

Response by Deborah R. Coen, Yale University

Let me start by saying how honored I am that Peder Anker, Paul Josephson, Zozan Pehlivan, and Daniel Stolz have taken the time to respond so thoughtfully to my research. Each author raises big, important questions, which deserve a more extended discussion than I can provide here. I will limit myself to addressing two related concerns that these responses share: first, the question of the uniqueness of the Habsburg Monarchy as a site of scientific knowledge production, and second, the present-day implications of locating the origins of modern climate science in an imperial state.

First, all four authors wonder to what degree the Habsburg Monarchy resembled other empires of the nineteenth century. How unusual were the conditions that it set for the sciences? At stake, it seems to me, is a piece of a larger question: as Anker asks, what exactly is the legacy of the Habsburg Monarchy for the environmental sciences? My contention in the book was that its legacies are twofold. First, I claimed that the Habsburg Monarchy provided a model for thinking beyond national borders for the sake of environmental analysis and governance, a model with influence beyond central Europe and into the twentieth century. In fact, Perrin Selcer's recent book, *The Postwar Origins of the Global Environment*, suggests to me that Habsburg practices of "scaling" may have found echoes in UNESCO's early efforts at global science. Second, I argued that the sciences in the Habsburg Monarchy bequeathed an ideal of what philosophers now call "scientific pluralism"—the pursuit not of a single, all-encompassing theory, but rather of a multiplicity of perspectives that cannot be unified, but only loosely coordinated. This epistemological stance has long been associated with thinkers with roots in the Habsburg world, such as Otto Neurath and Paul Feyerabend. But I argued that scientific pluralism flourished *in practice* in the Habsburg lands. That brings us to the comparative question: how distinctive was scientific practice in Austria-Hungary? This roundtable offers a welcome opportunity to compare the Habsburg version of "imperial science" to contemporaneous enterprises in Russia and the Ottoman lands.

Before delving into comparisons, it's worth remarking that the word empire may be a red herring here. Of course, I am guilty of having used the term generically in my subtitle, a shameless attempt to attract an audience to whom "Habsburg" would have sounded hopelessly esoteric. But historians have recently questioned whether the Habsburg Empire was an empire at all. After all, the constitutional structure of the Austrian half of the Monarchy after 1867 granted equal rights to all citizens regardless of language or religion. If an empire, by definition, governs different populations according to different norms, the term does not strictly apply to Austria-Hungary outside of Bosnia-Herzegovina. The idea of the Habsburg Monarchy as an empire like any other was strategically constructed by central European nationalists in the wake of the First World War. In fact, as Pieter Judson argues, the Habsburg constitution succeeded in laying the groundwork for a

transnational participatory democracy.[1] That achievement looks all the more impressive today, in light of the scourge of exclusionary, racist nationalism and the demise of democracy in much of this region. The question on the table, then, is not whether the Habsburg Monarchy was an empire like any other (it wasn't), but whether it set unique conditions for the sciences.

Luckily, these four essays bring us a step closer to answering that question, at least for the science of climate. Josephson helpfully reminds us that significant contributions to climate science came out of both imperial Russia and the Soviet Union, cases that certainly deserve more attention from historians. In Russia, as in Austria-Hungary, climate science depended on state-sponsored research institutions and served the state's economic and military needs. But Josephson asks whether climate science had a more "applied" character in Russia and the Soviet Union than in the Habsburg lands. Is it fair to say that Russian climate science was meant to support large-scale environmental engineering, such as irrigation and land reclamation projects, as well as extractive industry, while climate science in the Habsburg Monarchy was principally geared towards less intensive practices of agriculture and forestry? The evidence on this point is suggestive but not conclusive. Thanks to the work of Marianne Klemun and Robert Rosner, we know that Habsburg geologists and chemists did have close ties to mining and industry.[2] Likewise, Christian Marchetti reminds us that scientists from both halves of the Monarchy eagerly cooperated with the colonial mission in Bosnia. But I find it telling that, in certain cases, Habsburg scientists explicitly objected to the entanglement of science with expansionist and ecologically disruptive empire-building. Take, for instance, the Tyrol-based climatologist Heinrich Ficker, who criticized Russian climatologist Alexander Voeikov's artificial irrigation scheme for Russian Central Asia. Ficker argued that it was unwise to ignore the evidence that intensifying agriculture in the region was contributing to desiccation, a transformation that could not be undone by irrigation. Or take the example of Karl von Weyprecht, a captain and naturalist in the Austro-Hungarian navy, who co-directed the North-Pole Expedition of 1872-'74, where he became fascinated by Arctic meteorology. Upon his return, Weyprecht denounced the chauvinism associated with the race to the North Pole, in which scientific goals served as a cover for colonial ambitions. He quit the Navy in protest and dedicated his final years to working for international cooperation on polar research. Nonetheless, Ficker and von Weyprecht may not have been representative. We need further research on the involvement of Habsburg scientists with large-scale or extractive enterprises, such as the regulation

[1] Pieter Judson, *The Habsburg Empire: A New History* (Cambridge, MA: Harvard University Press, 2016), and "L'autriche-hongrie était-elle un empire?" *Éditions de l'EHESS: Annales. Histoire, Sciences Sociales* 63:3 (2008): 563-596.

[2] Robert Rosner, *Chemie in Österreich 1740-1914. Lehre - Forschung – Industrie* (Vienna: Böhlau, 2004), Marianne Klemun, "The Geologist's Hammer—'Fossil' Tool, Equipment, Instrument and/or Badge?," *Centaurus* 53 (2011): 86-101.

of the Danube, the short-lived Galician oil industry, and radium mining in Joachimsthal, as well as with military and colonial schemes in the Balkans.[3]

Pehlivan and Stolz offer more direct comparisons to the practices and epistemology of the sciences in the Ottoman Empire. Pehlivan suggests that Ottoman rulers celebrated the natural diversity of their lands much as Habsburg rulers did. Stolz compares what I call "scaling" in Habsburg science to an early nineteenth-century Ottoman mode of environmental governance, which relied on local knowledge rather than top-down standardization. How far, Stolz asks, did this localism go? As Stolz himself notes, it's a fascinating but thorny question precisely because historians have tended to investigate Ottoman intellectual production from the perspective of the imperial metropole. He raises an intriguing possibility: might Ottoman science look different from the perspective of the provinces? Stolz goes on to make a crucial observation about periodization: in the Ottoman case, the window of opportunity for bottom-up knowledge-making seems to have closed by the late nineteenth century. Late Ottoman science apparently served a univocal centralizing vision. I find Stolz's explanation for this shift compelling. He points to the pressure on Ottoman rulers to model their scientific pursuits on those of the British, French, and Prussian empires—that is, to promote scientific, technological, and medical ventures that were tightly centralized and theoretically unified. Had the Ottoman sciences instead privileged local viewpoints in the manner of state-sponsored science in Austria-Hungary, its practitioners would have risked being dismissed as pre-scientific.

Stolz, Pehlivan, and Josephson all raise important questions for future research on the field sciences in the Russian and Ottoman lands. At the same time, much remains to be learned about the Habsburg sciences. In particular, we need to know where the ideology and practices of Habsburg science met resistance. Working with sources in German and a smaller number in Czech, my research may have missed forms of resistance to what could have been perceived as a hegemonic, Austro-German style of science.

Let me turn, finally, to the most pressing and provocative question raised by these authors, most explicitly by Anker: what are the implications of *Climate in Motion* for the politics of climate science today? Might this narrative tarnish the science of global warming by associating it historically with imperialism? Should historians think twice about making this link, lest they provide skeptics with new grounds for dismissing the science?

On the contrary, I would say, present-day politics makes it all the more urgent to clarify how climate science has been entangled historically with colonialism, racism, and extractive capitalism. Our responsibility as historians is not only to uncover these connections but also to interrogate how they continue to shape the science

[3] Alison Frank, *Oil Empire: Visions of Prosperity in Austrian Galicia* (Cambridge, Mass.: Harvard Univ. Press, 2005).

today. Histories written to bolster the scientific consensus around anthropogenic warming have taken an exceedingly narrow perspective, crediting a few elite scientists in a limited range of disciplines. By ignoring the dependence of past science on the exploitation of humans and non-humans alike, such histories risk shoring up a scientific culture that perpetuates these forms of oppression.

True, my book is a work of European history that focuses primarily on the perspectives of white, male scientists. Yet my hope is that it provides a model for telling more inclusive histories of climate science. It interprets the production of knowledge of climate change as a process of "scaling"—that is, of negotiating between competing systems of measurement, or frameworks for relating the near to the far and the present to the past or future. The emphasis is therefore on the multiplicity of measurement systems in play—formal and informal, elite and vernacular. Moreover, if we recognize that scaling is an embodied, affective, and social process, then it becomes easy to see how the practice of climate science is always, inevitably, political. In these respects, my analytical framework speaks to Candis Callison's call for "multi-scalar, multicultural" narratives of climate change, with the aim of revealing the entanglement of scientific practices and discourses with specific histories of power.[4] What's more, telling the history of climate science as a history of scaling emphasizes the contingency of the dominant framing of anthropogenic climate change in the late 20th century, in terms of global-scale predictions of temperature and sea-level rise. Recalling the resolutely multiscalar origins of climate science underlines that the recent global framing has served the interests of industrialized countries at the expense of those most vulnerable to and least responsible for climate change. Finally, this history reminds us that there are alternatives to the consensus model of truth embraced by the IPCC. The demand for consensus has discouraged discussion of divisive topics and reduced conclusions to bland "least common denominators."[5] *Climate in Motion* demonstrates that the construction of modern climate science depended instead on scientific pluralism. In this sense, it is an argument for a more democratic approach to climate knowledge, engaging a wider variety of perspectives and ways of knowing.

My hope, then, is that *Climate in Motion* will inspire new historical narratives of the making of climate knowledge. Such narratives must attend to the ways that modern climate science has simultaneously appropriated and undermined vernacular, traditional, and indigenous forms of climate knowledge, along with the knowledge of disciplines that it relegated to the academic periphery, such as geography, botany, medical topography, and horticulture. Making climate science "global" has involved downplaying the role of local knowledge and the labor of vast numbers of what scholars of science and empire have called "knowledge brokers." As Pehlivan writes, we need to learn more about how "ordinary people have responded to both

---

[4] Candis Callison, "Climate Change Communication and Indigenous Publics," Oxford Research Encyclopedia of Climate Change, DOI: 10.1093/acrefore/9780190228620.013.411.
[5] Shardul Agrawala, "Structural and Process History of the Intergovernmental Panel On Climate Change," *Climatic Change* 39 (1998): 621–642, on 627.

environmental changes, and environmental science, at the local level." Doing so will not only allow us to write more inclusive narratives. It may also help to reveal the enduring legacies of feudal, capitalist, colonial, and racist hierarchies in today's science. It may even help to recover alternative ways of knowing, valuing, and interacting with the non-human world. Pehlivan asks whether historical accounts of interactions between elite and common knowledge might inform how scientists and the public interact today around global warming. I think so. Communicating the wide range of actors, places, and practices relevant to the history of climate science may help, in particular, to build the confidence of non-scientists today in their own abilities to make climate knowledge—at a moment when such knowledge is increasingly a matter of survival.

About the Contributors

Peder Anker is Associate Professor of History of Science at New York University and Professor II in History at the University of Oslo. He is the author of *From Bauhaus to Eco-House: A History of Ecological Design* (2010), and *Imperial Ecology: Environmental Order in the British Empire, 1895-1945* (2001). *The Power of the Periphery: How Norway Became an Environmental Pioneer for the World* is forthcoming at Cambridge University Press this year. More at www.pederanker.com and Twitter @pederanker.

Deborah R. Coen is Professor of History and Chair of the Program in History of Science and Medicine at Yale University, where she is also a member of the steering committee of the Environmental Humanities Program.

Paul Josephson writes about big science and technology in the twentieth century. His *Chicken* will be published by Polity Press soon, and he recently finished a study of environment, technology and state power in Russia.

Zozan Pehlivan is an Assistant Professor of History at University of Minnesota-Twin Cities. Her research concerns the environmental, socio-political, and economic history of the Middle East with a particular focus on pastoral nomadism and domesticated animals. Her latest publication, entitled "El Niño and the Nomads: Global Climate, Local Environment, and the Crisis of the Pastoralism in Late Ottoman Kurdistan," is forthcoming in the *Journal of the Economic and Social History of the Orient*.

Daniel Stolz is the Kemal H. Karpat Assistant Professor of History at UW-Madison. He is the author of The Lighthouse and the Observatory: Islam, Science, and Empire in Late Ottoman Egypt (Cambridge University Press, 2018).

Keith Makoto Woodhouse is an associate professor of History and director of the Environmental Policy and Culture Program at Northwestern University. He is the author of *The Ecocentrists: A History of Radical Environmentalism*.