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## Ecological Form

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From Specimen to System  
Botanical Scale and the Environmental Sublime  
in Joseph Dalton Hooker's Himalayas

*Lynn Voskuil*

The question of scale has recently become a consequential matter for the humanities, even (or perhaps especially) when it is not explicitly theorized. It motivates the world literature movement, for example, which has reimagined literature as a transnational, even planetary, system that challenges our conceptions of singular texts and defies the conventional moves of close reading.<sup>1</sup> It is likewise implicated in our new, wider sense of the human as linked to other sentient creatures and insentient objects in ontologically variable assemblages that prompt a more ecologically sensitive ethics.<sup>2</sup> In such formulations, scale is often loosely affiliated with “distance” or “extent”: We must learn new ways, it is said, to study literature as an infinite, planetary (and not merely a national or even international) phenomenon, and we must broaden our traditional notion of humanity as unique and exceptional—a notion that has inspired the study of literature for centuries. While these are crucial claims, the assumptions that ground much of this scholarship tend to downplay the relations between scales and the process of scaling, the moves that enable both a close focus on and a panoramic view of the objects we study—and the inevitable distortions that ensue. What scales are, why they matter, and how we move among them

thus remain underexplored problems for the humanities. As David Palumbo-Liu, Bruce Robbins, and Nirvana Tanoukhi have recently noted, “The gravitational pull of the world scale is clear. What that scale ought to mean to us remains a conundrum.”<sup>3</sup>

The consideration of scale is especially important for the branch of humanities that focuses on political and environmental ecologies. While ecological scholarship in the natural sciences recognized the importance of scale long ago, that realization has come more slowly to the humanities and social sciences: Only recently has our study of literature and culture been scaled to a cosmic arena and our awareness of time been expanded from the countable centuries of literary history to the vastness of time implied by the Anthropocene.<sup>4</sup> The challenge is not simply that our objects of study are either small or (newly) large; the challenge is that our very objects and methods of study are themselves transformed by the process of scaling. This essay takes up that challenge by following the lead of ecologists and viewing the concept of scale as a perceptual and hermeneutical problem. Scale may still be a “conundrum” for the humanities because we no longer fully recognize our objects and systems of study, transformed as they now are by new explanatory models. What we see, in other words, “is contingent upon the window through which the system is viewed,” as ecologist Simon Levin has put it.<sup>5</sup>

While this intellectual problem is urgently of-the-moment, its antecedents lie in nineteenth-century texts and disciplines that broached the question of scale in variable ways, frequently as a feature of the imperial project. The natural sciences registered the global implications of these issues with particular force because they were central to Britain’s imperialist motive and quest. As historian of science Janet Browne has observed, “the study of animal and plant geography in nineteenth-century Britain was one of the most obviously imperial sciences in an age of increasing imperialism.”<sup>6</sup> Integral to the imperial project was an ever more complex awareness of the Empire’s vast dimensions, an awareness that spurred in turn the development of epistemologies that began to theorize and apply scalar heuristics in a global arena. This essay explores the problem of scale, and its global ramifications, in two volumes by Victorian botanist Joseph Dalton Hooker: *Himalayan Journals* (1854), the narrative of Hooker’s midcentury travels through Bengal and the Himalayan mountains collecting plants; and *Flora Indica* (1855), the first installation of a large, systematic botany that aimed to catalogue many of those findings.<sup>7</sup> As one of the most ambitious and renowned plant scientists in the nineteenth century, Hooker was keen to transform the practice of botany from a mere focus on individual speci-

mens to a discipline that also considered global patterns and distribution of plants. With its account of his exploratory travels from 1847 to 1851, *Himalayan Journals* records Hooker's early efforts to grapple with these intellectual problems, while *Flora Indica* systematically explains some of his central intellectual principles. Key to the effect of these volumes was Hooker's mix of rhetorical approaches, approaches we would now characterize as variably "scientific" or "literary" but that he melded to represent plants, his own objects of study. Attention to these now little-read texts brings to the fore many ambiguities of global scale that are still with us today, especially in the humanities.

Hooker was not an early environmental activist. Indeed, as an employee of the British government and a proponent of "economic botany"—the practical study of plants for the purpose of enriching the Empire—he contributed to Victorian experiments that eventually enabled some of the problematic effects we still experience from (for example) massive industrial agriculture. And his intellectual achievements cannot, of course, be separated from either their imperialist motives or their environmental effects: the moral, cultural, and ideological catalysts that propelled the British Empire continue to fuel the kind of "slow violence" that Rob Nixon has discussed so eloquently.<sup>8</sup> At the same time, the effects of Hooker's work are not fully explained by their ideological intentions or contexts. Perplexed by plants that could thrive both in his British garden and in the Himalayan mountains, he began to cultivate an interpretive awareness that could make sense of, and move between, these disparate global regions—a form of awareness that resonates beyond its immediate geopolitical environment. While Hooker did not wholly solve the problems of scale he encountered, he was awake to the hermeneutical uncertainties that emerge when a global consciousness is cultivated. His methods are thus not quite captured by the smooth workings of what Bruno Latour has called the "zoom effect," the cinematic effect that makes movement from the close-up to the panorama seem natural and frictionless.<sup>9</sup> Instead, for Hooker, the shift from an individual object of scrutiny to its global range presented enormous perplexities—and enormous friction. In the mid-nineteenth century, in fact, he anticipated what Timothy Clark has called "scale effects," making this methodological issue an object of study in its own right.<sup>10</sup>

### *Specimens and Systems*

Hooker's involvement with questions of scale has its roots in nineteenth-century conventions of botanic study. In his own era (and earlier), botany—

like the many allied branches of natural history—was both an amateur and professional pursuit, and many of its practitioners were assiduous collectors.<sup>11</sup> As Anne Larsen says, “Natural history in this period was a science based on *specimens*”—on the singular insect, rock, barnacle, taxidermied bird, or, for botanists, the individual plant.<sup>12</sup> Hooker was himself deeply involved in the pursuit and study of individual species and often mired in the detailed minutiae of locating, identifying, recording, and preserving specimens, whether he was collecting them himself or instructing others. As a traveler in his early career, he amassed an impressive herbarium, with plants collected when he was an assistant naturalist on the so-called “Magnetic Crusade” to Antarctica, and then as the lead naturalist on the journey through Sikkim, Nepal, and Bengal that is chronicled in *Himalayan Journals*. Hooker’s own writing, moreover, often features a focus on the individual specimen. An important outcome of his Himalayan travels, for example, was his discovery of many species of rhododendron not then known in the West. In 1849, before he returned from his Himalayan trip and with the help of his father back in London (the director of Kew before him), Hooker published *The Rhododendrons of the Sikkim-Himalaya*, a large, lavishly illustrated volume that featured just this kind of species description with the purpose of introducing these new rhododendrons to both botanists and horticulturists (see Figure 2).<sup>13</sup>

Hooker, however, aimed to move beyond mere collection, description, and classification of individual species—although classification in particular remained an important, time-consuming task in an era of rapidly expanding herbaria. Ambitiously, as Jim Endersby has shown, he wanted to elevate botany to a “philosophical” level and transform it into a science that could compete socially and intellectually with chemistry, physics, mathematics, and even astronomy.<sup>14</sup> Only when botanists transcended the local distribution of a species, Hooker argued—only when they could document its potentially global reach—would botany gain a truly systematic foundation and plants be “classified upon philosophical principles” (*Flora* 8).

Hooker was not the first European botanist to scale his study of plants to a global arena. Indeed, Browne’s narrative of what she calls “biogeography” begins in the early seventeenth century, with theologians who sought to explain, often by interpreting Genesis literally, how animals exiting Noah’s ark repopulated the entire earth. The recognition of exotic species, even in the seventeenth century, prompted an awareness of geographical regions around the world that could accommodate the different survival needs of variable flora and fauna, an issue that natural historians also took



Figure 2. *Rhododendron Dalbousiae*, an example of a species description provided by a single specimen (1849–51). (Image from Joseph Dalton Hooker, *The Rhododendrons of the Sikkim Himalaya*, reproduced by kind permission of the Board of Trustees of the Royal Botanic Gardens, Kew.)

up. By the end of the eighteenth century, however, as reliance on the Noahian story declined, plants assumed a more significant position than animals in emerging studies of global migration and distribution. Literally rooted in the soil, plants were tied more closely to the physical environment, thereby serving as more reliable biogeographical markers.<sup>15</sup> Late-eighteenth- and early-nineteenth-century plant scientists thus played an important role in the development of global study. Joseph Banks, Hooker's eighteenth-century predecessor at Kew, was himself an intrepid explorer who bolstered Kew's collections of exotic specimens and worked with King George III to establish the botanical garden as a center of agricultural "improvement" in the service of empire.<sup>16</sup> Banks, however, produced few significant writings and was known more as an entrepreneur and manager than as an important botanist; while he expanded Britain's scientific networks, he spent little time pondering global theory.<sup>17</sup>

Although Hooker learned administrative lessons from Banks's tenure at Kew, he was inspired intellectually (if sometimes indirectly) by scientists who studied global plant migration and distribution in the early nineteenth century. Perhaps chief among these was Alexander von Humboldt, the German explorer-philosopher-scientist and prolific author whose wide influence in nineteenth-century Europe, Britain, and America is difficult to over-state; Susan Cannon, in fact, has described the first half of the nineteenth century overall as the era of "Humboldtian science."<sup>18</sup> Among Humboldt's many innovations was the invention of the isobar, a cartographic line that links points with the same atmospheric pressure around the world, and the isotherm, a similar device that joins points with the same minimum or maximum average temperatures; both became mechanisms for the transaction of scientific study on a global scale. Also influential were the French scientist Augustin-Pyramus de Candolle and (especially for Hooker) the British botanist Robert Brown.<sup>19</sup> Hooker's advances paralleled and built on the work of these earlier botanists, but he also crucially circulated the central premise of distribution studies: the conviction that botany should be studied from a global perspective. Himself a prolific correspondent and collaborator, Hooker discussed his ideas with many other scientists—including his close friend Charles Darwin (to whom the *Himalayan Journals* are dedicated)—thereby extending the reach of global thought in British intellectual circles and, through his position at Kew, in the wider culture as well. Revered then as one of the most important nineteenth-century botanists, Hooker developed and spread methodologies that linked global botanic communities as well as the scalar heuristics that were implied by such methods.

With their emphasis on both global plant communities and species classification, Hooker's goals for botany entailed principles of study that necessitated processes of scaling, processes that move from observation of the individual specimen to analysis of its distribution around the world and that involve the inference of relations among different spatial scales. As Benjamin Morgan has observed, scales "structure perception . . . by defining levels of granularity."<sup>20</sup> For centuries, botanists had carried out their study largely by viewing a single specimen closely, on a very localized scale: by counting and labeling its parts and viewing them microscopically, by comparing it to other specimens, even by touching its leaves and stems. While Hooker used these observational practices, he didn't fully trust the authority even of his own, well-trained eyes—a posture of skepticism that testifies to his excellence as a botanist. As Lorraine Daston has shown, nineteenth-century botanists looked to "type specimens" for classificatory purposes. Whether they existed as desiccated herbarium specimens or botanical illustrations (see Figure 2), these types were supposed to exemplify the species neither naturalistically (as in the field) nor idealistically (as the one essential specimen); instead, type specimens were seen as the distillation of many examples of the species.<sup>21</sup> The individual example of a species—in the field or elsewhere—was thus not interpreted in its own singularity; indeed, its unique qualities, often notable to gardeners and horticulturists, were seen as radically insufficient, even detrimental, to the task of accurate classification. The solution to such finely scaled botanic myopia, then, was itself a solution of scale: While close sensory inspection was an essential element of accurate classification, the observed plant must be placed within a much larger class of similar examples and one scaling mechanism be used instead of—or in addition to—another.

Hooker argued, however, that plants should be studied not only as individual species but in larger, even global aggregates. In *Flora Indica*, he states the principle at stake: "It will be generally found that botanists who confine their attention to the vegetation of a circumscribed area, take a much more contracted view of the limits of species, than those who extend their investigations over the whole surface of the globe" (13). But an individual botanist could obviously not personally inspect all existing specimens—or even representative specimens—on a world-wide basis. How, then, could the study of plants be made globally systematic? Hooker addressed this question by taking a methodological cue from Humboldt: He emphasized the frequent recording of measurements and data. Such measurements are a significant representational feature even of *Himalayan Journals*, a volume that targeted a wide audience (in distinction from *Flora Indica*,

which assumed a more specialized readership). While the *Journals* echo other nineteenth-century travel genres by offering descriptions of the people and customs he encountered along the way, the inclusion of calculations and figures is both insistent and persistent. A typical example occurs deep into the first volume: “The mean temperature of the twenty-four hours was 32.7 (max. 41.5/ min. 27.2), mean dew-point 29.7, and saturation 0.82. . . . The black bulb thermometer rose to 132, at 9 a.m. on the 28th, or 94.2 above the temperature of the air in the shade” (*Journals* 1:310–11). This quotation, excerpted from a much longer paragraph that provides many additional figures, exemplifies a commonplace of this text. Far from an incidental stylistic tic, these calculations are important because they register Hooker’s effort to make use of different scales. Relationships among scales were significant for him, and the question of how to move among them was a vexing problem.

Hooker’s use of data helped him address this problem. In data, Hooker and other botanists such as Humboldt and Brown—as well as the many other nineteenth-century scientists who shared their convictions about the power of data—found a tool that enabled them to chart global phenomena, even those they couldn’t observe firsthand. Jen Hill has recently illuminated the significance of such pursuits with her analysis of “correlation” in Francis Galton’s study of the “thermodynamics of weather.” As Hill argues, Galton’s work revealed “correlation to him—the ways in which local conditions were part of larger systems, determined and thus explained by literally invisible forces and geographically distant patterns.”<sup>22</sup> Hooker, it might be said, anticipated Galton’s attraction to “correlation” by using the data he recorded in his travels to represent what he calls, in *Himalayan Journals*, “zones” and “belts” of plant distribution (*Journals* 1:142–43 and 1:348–49). He explores such concepts more extensively in *Flora Indica* by theorizing a region he called the “botanical province” and dividing the ground covered by his *Flora* into dozens of such provinces (88). Hooker found this division process to be “a very much more difficult task than might have been supposed” because the lines he drew conformed to “physical features rather than arbitrary lines” or “political boundaries” 84, 88). His botanical provinces were circumscribed, in other words, by the botanic, climatic, geological, and geographical measurements he had so carefully recorded throughout his travels.

These provinces, and the challenges of delineating them, play a significant ideological role in Hooker’s work. In charting them, first of all, he ignored the current boundaries of British possessions in the South Asian continent, surveying instead a region that was much larger. As an employee

of the British government, Hooker was paid to explore territory, plants, and scientific data that would benefit the Empire—especially, in this case, its Indian colonies. In and of itself, the act of redrawing regional boundaries could be construed as problematic from the standpoint of empire. Although Hooker's intention was certainly not to subvert government objectives, his indifference to the boundaries of British possessions, and his use of physical data to chart his provinces, implicitly challenged the criteria that dictated the establishment of territorial borders.<sup>23</sup> Beyond this geopolitical provocation, Hooker's provinces also tested the limits of current ideologies that governed the study of botany, a provocation he took up more explicitly. Aware of potential controversy, he devoted several pages in *Flora Indica* to defending the breadth of its geographical reach and rationalizing the provincial borders he outlined (83–90). One of his stated goals—both for *Flora Indica* and for the study of plants more generally—was to “banish prejudice from the domain of Systematic Botany” by demonstrating the enormous geographical range of many botanic species (*Flora* 88). This range not only ignored political boundaries but also directly countered the common practice, widespread among practical nineteenth-century botanists, to proclaim a new species when an unfamiliar plant was discovered and thereby, according to Hooker, falsely inflate the total worldwide number of species, a practice he deplored as “*hair-splitting*” (*Flora* 13). He believed that even the study of plants was informed by “a proneness of the human mind to regard everything from an unknown country, or that is seen surrounded with foreign association, as itself unknown” (*Flora* 87). Instead of perceiving a new species each time he encountered an apparently unfamiliar plant in a new region, Hooker assumed that it probably existed elsewhere in the world; and he then searched for it, using his own observations and collections, the work of other botanists, and the physical data he recorded and charted. The resulting botanical zones traversed national and even some natural boundaries (mountain ranges, for example), drawing the plant world together in “large cosmopolitan families” that rambled far beyond the localized species groups identified by many botanists (*Flora* 90).

Visual representations of these zones differ strikingly from more conventional representations of plants. The lithographs in Hooker's opulent rhododendron volume exemplify what had become traditional botanical illustration by the mid-nineteenth century (see Figure 2); the influence of Linnaean taxonomy is reflected in a close-up of the flower, with reproductive parts drawn separately, enabling a granular, finely scaled focus on a single specimen.<sup>24</sup> In *Flora Indica*, although Hooker devoted many

pages to verbal species descriptions, he included no such specimen drawings, offering instead only two cartographic images. While one map shows the physical geography of India, the other represents isothermal belts that loop across several nations and continents, including South Asia, East Asia, Africa, and Europe (see Figure 3). Originating, as Hooker noted, in *On the Distribution of Heat over the Surface of the Globe* (1853), a recently published work by pioneering climatologist Heinrich Wilhelm Dove translated by Elizabeth Sabine, this map displays the kind of physical data that corresponded to the plant distributions Hooker charted (*Flora* 258). It thereby graphs the potential range of a so-called “English” plant that might also be found in, say, India, linking both plants and data into large-scale aggregates that ignored national borders.

The zones represented by the isothermal map and the measurements typified by the figures Hooker inserted prolifically into *Himalayan Journals* could presumably have conferred the certainty and respect he sought for the pursuit of a globalized, “philosophical” botany. As Mary Poovey has argued, the practices of counting, measuring, and figuring had assumed a new primacy in the late eighteenth and early nineteenth centuries, a shift that gave such data a new credence and authority derived from their ostensible neutrality. Hooker’s use of botanic zones and belts could even be seen as a partial response to what Poovey calls “the problem of induction” because, as she puts it, “measuring, counting, and figuring proportions and variations would bridge the gap between the observed particular and general knowledge.”<sup>25</sup> Maps and tables of physical data that arranged global plant communities in “cosmopolitan” families might be used in this way, deployed as a mechanism to move from the single plant specimen to their world-wide distribution. Hooker did not make this argument explicitly in either *Himalayan Journals* or *Flora Indica*, however. Instead, he acknowledged the frequently difficult task of making scalar moves from a single specimen or individual site to global plant communities. His *Himalayan Journals* are especially important in this regard. While the more systematic *Flora* sets forth his intellectual principles and ambitions for botanic study, the less conclusive *Journals* includes his on-the-spot ruminations and reflections on what he was discovering and collecting. Indeed, the very form of the journal as a genre—a form whose generic conventions are often used to note and work through intellectual or emotional ambiguity—enabled Hooker to voice equivocations and skepticism about his initial findings. The *Journals* are thus a useful record of his perplexities about how scale works in the field. Notably, he conveys these perplexities not by

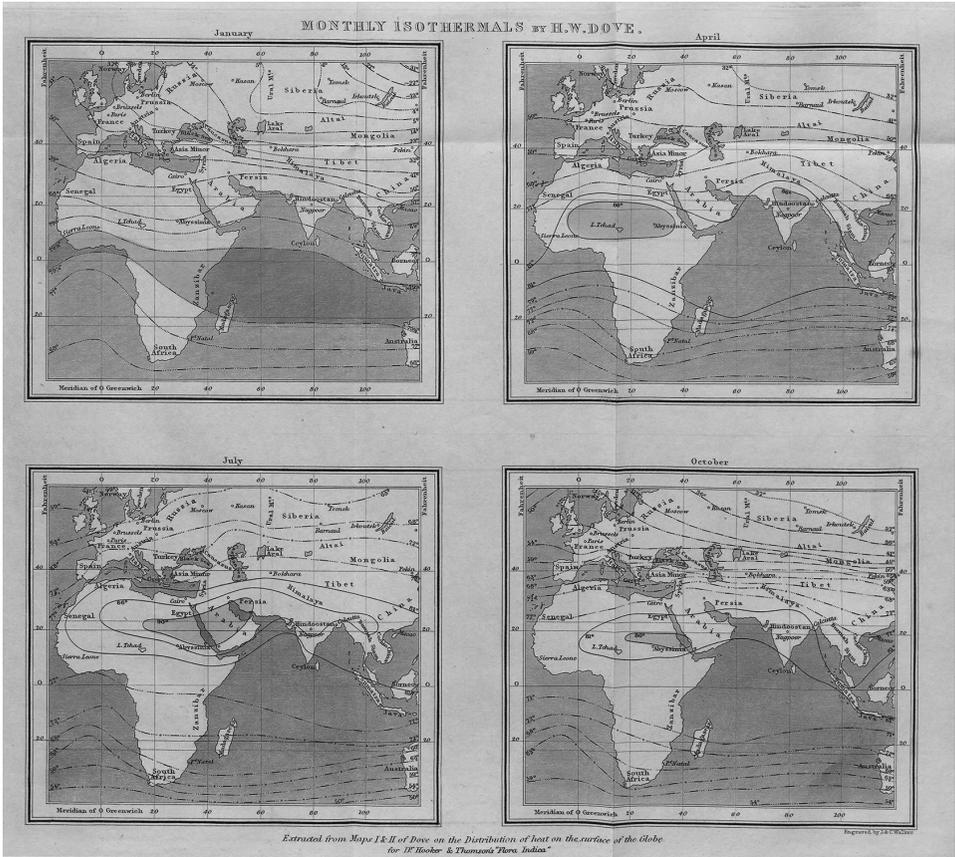


Figure 3. Isothermal zones, one of two illustrations from *Flora Indica* (1855). (Image reproduced courtesy of Biodiversity Heritage Library.)

reworking or questioning his data but by adapting the aesthetic conventions of the sublime and the perspectival framework of landscape.

### Scalar Distortions

These conventions, and their relations to scale, are introduced early in *Himalayan Journals*, when Hooker first notes a radical zonal shift in physical phenomena. He is in the Himalayan foothills, having proceeded northward from Calcutta (Kolkata) through the states of West Bengal and Bihar. “Every feature, botanical, geological, and zoological, is new on entering this district,” he notes. No “botanical region [is] more clearly marked than this,

which is the commencement of Himalayan vegetation” (*Journals* 1.100). Commenting during his first ascent into the Himalayas proper, he expresses his amazement at the size of the plant and animal species he was encountering. “Upon what a gigantic scale does nature here operate!” he marvels (*Journals* 1.104). “The prevalent timber is gigantic,” he continues, “and scaled by climbing *Leguminosae*, as *Baubinias* and *Robinias*, which sometimes sheath the trunks, or span the forest with huge cables, joining tree to tree. Their trunks are also clothed with parasitical Orchids, and still more beautifully with Pothos (*Scindapsus*), Peppers, *Gnetum*, Vines, Convolvulus, and *Bignoniae*” (*Journals* 1:108). Hooker here evokes some apparently standard meanings of scale. In the tropical landscape, first of all, plants scale each other: Vines use larger, more stable species as ladders or steps to reach the sunlight. Both flora and fauna, moreover, vastly exceed their counterparts in the temperate climates Hooker knew best; not only do plants grow taller and reach further, but they are far more dense and profuse than the plants in European landscapes.

While fairly straightforward, these intimations of scale are more complex and allusive than their uses here might initially suggest. Hooker’s descriptions of tropical forests near the Himalayas once again echo those of Humboldt, most notably those included in his *Personal Narrative of Travels to the Equinoctial Regions of the New Continent, 1799–1804*. Humboldt’s evocations of tropical landscapes in that work had become something of a convention in naturalist writing and themselves drew on turn-of-the-century evocations of the sublime and the picturesque.<sup>26</sup> As Humboldt wrote, for example, “everything is gigantic” in the forest of South America, “the mountains, the rivers, and the mass of vegetation. . . . The trunks of the trees are every where concealed under a thick carpet of verdure. . . .”<sup>27</sup> Hooker draws on similar aesthetic conventions. “Dissolving views gives some ideas of the magic creation and dispersion of . . . effects,” he notes, “but any combination of science and art can no more recall the scene, than it can the feelings of awe that crept over me, during the hour I spent in solitude amongst these stupendous mountains” (*Journals* 1.266). The evocation of sublimity and the echo of Humboldt in *Himalayan Journals* not only place Hooker in a nineteenth-century tradition of botanical writing but also show him reaching for available aesthetic means to grasp the scale of what he was observing in the Himalayas.<sup>28</sup>

It is no surprise that Hooker used familiar aesthetic conventions to describe Himalayan scenes. In preceding decades, of course, Romantic poets had often evoked the sublime to capture their own responses to nature, with mountain prospects figuring significantly as triggers of awe or

terror. A long, subsequent critical focus on the literary and philosophical sublime—too lengthy and complex to unpack here—reached something of a consensus in the late twentieth century that the sublime had been individuated, internalized, and (often) domesticated in the nineteenth century, eventuating in a concept of sublime nature that came to be “nothing without the mind’s imaginings,” as David Simpson has put it.<sup>29</sup> This philosophical correlation of sublimity with human subjectivity has itself been affiliated with the imperialist project, as Simpson also notes. The “coincidence” of an egotistical sublime “with the expansion of empire and capital,” he writes, “might cause us to suspect that there is something ethically uncomfortable at the heart of our craving for bigness and our urge to set ourselves against enormity in a process of cognizance or conquest, whether of depth, space, or territory.”<sup>30</sup> In a related trope of territorial mastery—the vision of the imperial explorer metaphorically conquering the sublime scene he surveys by aestheticizing it—Mary Louise Pratt identified a potent, Victorian version of this urge and found it embodied in the figure of the explorer Richard Burton.<sup>31</sup>

Hooker’s evocations of sublimity in *Himalayan Journals* thus come with a heavy load of ideological freight. His uses of the sublime, however, while recognizably rooted in their era, attenuate some of these ideological associations. Consider the quality that Edmund Burke had called “vastness” or “greatness of dimension,” a “powerful cause of the sublime” featured in his *Enquiry into the Sublime and Beautiful*.<sup>32</sup> Hooker predictably emphasizes this quality in his descriptions of the Himalayas, echoing other writers who had made similar observations about the European Alps. Provocatively, though, he often disrupts this emphasis by reframing even the most marvelous Himalayan spectacles with remarks about scalar distortions that cloud the viewer’s perceptions. He tackles these circumstances immediately in the preface, where he discusses the landscape illustrations included in the volume, which were made from his own sketches (see Figure 4). Observing that his drawings would be considered “tame” if compared with those of landscape artists who exaggerate certain features, he adds that “the total effect of steepness and elevation, especially in a mountain view” could not be accurately represented in a “small scale,” accurately proportioned sketch (*Journals* xviii).

This theme of scalar distortion is sustained throughout the text no less insistently than the emphasis on measurement and often in scenes that are framed as sublime. Chapter 5, for example, opens with the disclaimer, conventional in representations of sublimity, that these “sublime phenomena”—his first view of the highest, snow-clad elevation in the Himalayas—“elude

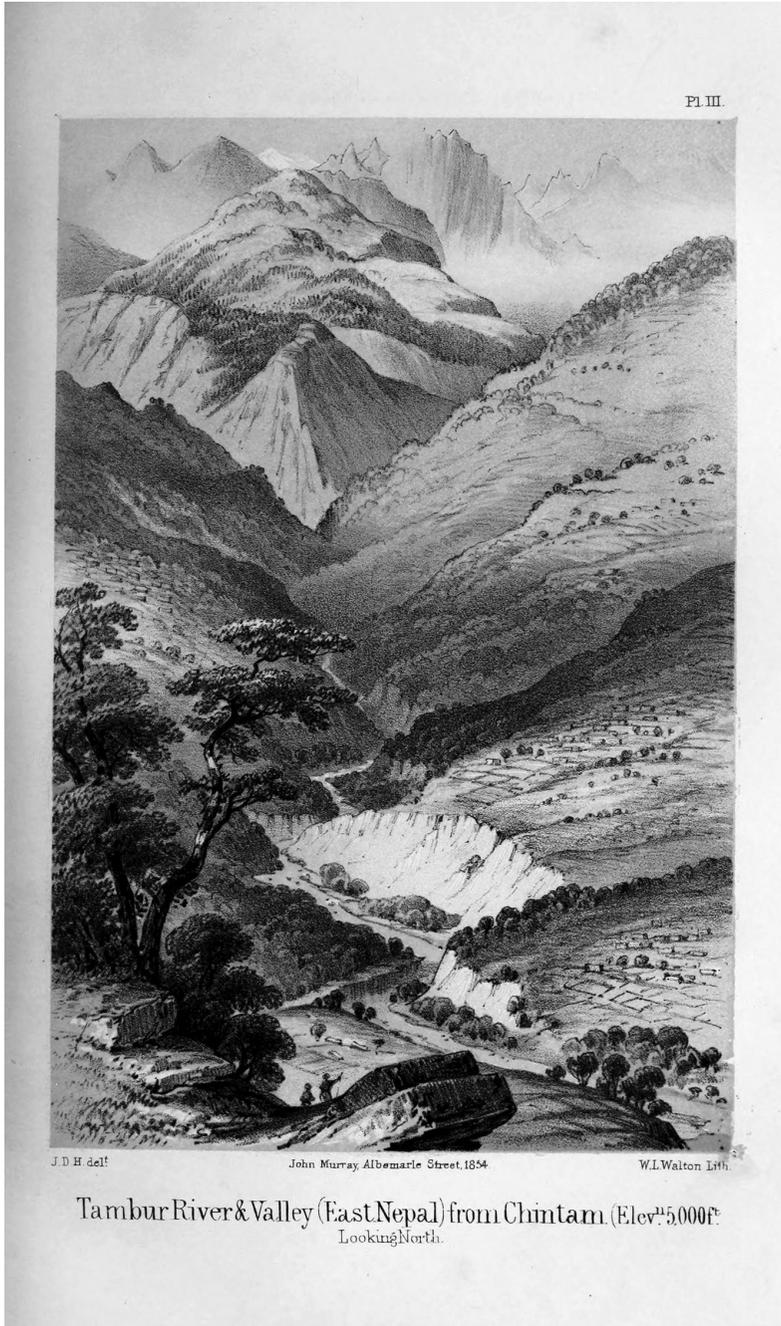


Figure 4. A lithograph of the Himalayan landscape, probably based on a sketch made in the field by Hooker (1854). (Image from Joseph Dalton Hooker, *Himalayan Journals*, reproduced courtesy of Biodiversity Heritage Library.)

all attempts at description.” Also conventionally, Hooker then proceeds to describe them nonetheless, including the “sensations and impressions that rivet” him to the scene (*Journals* 1:123). But he follows these conventions with a series of figures that record latitude, elevation, and the angles of peaks with respect to the horizon. The latter, taken with a theodolite (a surveying instrument), are far smaller than expected and clash sharply with the apparent enormity perceived by the naked eye (*Journals* 1:124). For Hooker, sheer size was only part of it; proportions and relations of scale are equally at stake here, no less than immensity.

In this case, the use of equipment seems to address the ambiguities of scalar distortion, thus elevating the scientist to a position of cognitive conquest: like Pratt’s Burton, Hooker uses Western knowledge to survey the scene and shrink it down to size. In several other cases, however, doubting even his own instruments, Hooker implies that the scale of Himalayan nature is almost beyond the measure of Western perception. One such episode is especially illuminating, noted when he was looking northward toward Tibet and westward toward Nepal from an elevation of 20,000 feet in the Sikkim Himalayas. “This wonderful view,” he remarks, “forcibly impressed me with the fact, that all eye-estimates in mountainous countries are utterly fallacious, if not corrected by study and experience.” After a lengthy description, he concludes with a hermeneutical image. “The want of refraction to lift the horizon, the astonishing precision of the outlines, and the brilliancy of the images of mountains reduced by distance to mere specks,” he marvels, “are all circumstances tending to depress them to appearance. The absence of trees, houses, and familiar objects to assist the eye in the appreciation of distance, throws back the whole landscape; which, seen through the rarified atmosphere of 18,500 feet, looks as if diminished by being surveyed through the wrong end of a telescope” (*Journals* 2:127–28). As Hooker attempts to make sense of the panorama in front of him, he reaches instinctively for tools of his trade that he can use to measure it—to gauge, calibrate, and enumerate its features and to generalize from these data, as he had when he designed his botanical provinces. In this case, however, there are no humanized elements of landscape—no “trees, houses, and familiar objects”—that can be used to scale his view in this way, with the result that his instrumental grasp of the surroundings is shaky at best. Notably, even the trusty telescope has become unreliable, a tool that now distorts the scene rather than clarifying it. Here, in other words, even “study and experience” are not definitive. In fact, by shrinking the scene, the telescope paradoxically magnifies the contortions of the scale effect, an effect so potent that it can shrink a global entity—the highest

mountain in India, say—into a pocket-size landscape. At this point, far into his journey, Hooker frames himself and the lofty scene with obscurity rather than clarity, as if to underscore its strangeness once more, just as he did when he first began to ascend the Himalayan foothills.

Throughout *Himalayan Journals*, Hooker frequently reaches for the language of the sublime when he is faced with the vastness of his methodological challenge, which includes the shifting scales on which his work must be carried out if botany is to become “philosophical.” At such moments, the authority of his own senses, measurements, or experience appears diminished. Prevailing in this and many related scenes in the *Himalayan Journals* is an emphasis on the immeasurable mysteries of the surrounding atmosphere and biosphere, the sense that their properties exceed the capacities of even the scientific mind to comprehend them. Rather than verifying his scientific subjectivity, then, the Himalayan panoramas often undermine it, exemplifying what Emily Brady has called the “the environmental sublime,” an ontological state characterized by “an overwhelming of the subject, in which the self is dislocated through a sense of nature as mysterious, and neither fully known nor appropriated by human reason.”<sup>33</sup> In distinction from the egotistical sublime that Simpson (and Keats) discusses, Brady’s notion destabilizes both the subject’s self-awareness and the knowability of the natural scene, including the subject’s own position within it. For Hooker, the Himalayan mountains were not easily conquered in aesthetic, cognitive, or imperial terms. Instead, their very presence—their vastness, their inscrutability, their indifference to geopolitical boundaries—registered the limits of his politics, his senses, and even his science.

That Hooker frames the sites of his bafflement as themselves framed is significant for several reasons.<sup>34</sup> His decision, first of all, to frame them as sublime underscores the difficulty not merely of grasping the scenes but of representing them. When he evokes the sublime, he takes advantage of an aesthetic vernacular familiar to his British audience, a language that humanizes his scientific findings in ways that his readers will fathom. This very familiarity, however, guarantees that his uses of the sublime—a set of tropes that was well-worn by mid-century—will call attention to themselves as representational tools. And they do so precisely at that point when the environmental sublime makes itself felt, when the scientist is confronted with the unfathomability of his natural object of study. This incongruence—the use of highly conventionalized language when faced with a profoundly unconventional vista—underscores the practice of globalized study as a hermeneutical enterprise. By using tropes of the sublime, Hooker suggests that even the most natural, untouched sites and objects imagin-

able must be mediated by cultural and methodological mechanisms. Secondly, however, his work also demonstrates the limits and constraints of the very mechanisms it deploys. If readers miss the significance of the sublime frameworks in *Himalayan Journals*, they might more readily grasp the framing functions of his instruments and measurements: the theodolite that makes the highest mountains in the world seem small, the telescope that shrinks entire panoramas. On the one hand, these instruments challenge sensory evidence—ocular testimony, for example, unsupported by scientific aids. On the other, they remind both Hooker and his readers that scientific instruments, like the human eye, are themselves lenses that leave certain elements out of the picture. With a theodolite, you can measure the angles of distant mountains with respect to the horizon, but there is not much it can say about the botanic specimen at your feet.

In the end, though Hooker made many important advances in the global study of plants, he did not fully solve the methodological and, especially, the hermeneutical issues he raised. This condition of his work perhaps explains why there is a lingering sense of “the environmental sublime” in both of his mid-century texts but most notably in *Himalayan Journals*—the sense that natural objects of study, whether small or enormously large, cannot be fully grasped even with sophisticated instruments. This conundrum speaks to conceptions of scale both now and in the nineteenth century. Today, perhaps building on Hooker’s now distant legacy, ecologists explicitly recognize that “there is no natural level of description,” as Levin puts it; scales are observational tools that necessarily focus on variable kinds of information.<sup>35</sup> This recognition, seemingly leaves little room for an environmental sublime as Brady explains it: All natural phenomena are scientifically explicable, if not currently then eventually. Instead of relinquishing apparently natural phenomena to a quasi-metaphysical realm, “the key,” as Levin says, is to recognize scalar variability, “to determine what information is preserved and what information is lost as one moves from one scale to the other.”<sup>36</sup> One hundred and fifty years earlier, Hooker was awake to the ambiguities of these interpretive and scalar questions and brought them to the attention of fellow botanists and popular readers even as he furthered his scientific agenda. Rather than using aesthetic tools to invalidate quantitative results, however, or drawing on exclusively quantitative tools to solve his interpretive problems, Hooker employed both representational modes to highlight the processes of scaling and to carry out the difficult epistemological task of moving from the observation of the local, individual object of study to the development of global, systematic knowledge.

The provenance of this critique in nineteenth-century science remains provocative for the humanities today. Our turn to the question of quantity—"that forgotten 99 percent" of nineteenth-century British novels, as Franco Moretti puts it<sup>37</sup>—is an important, even crucial, turn. At the same time, as Hooker's work exemplifies, quantitative methods are not, in and of themselves, sufficient, nor is neglect of the individual object of study a prerequisite for global analysis of various kinds, including distant reading. If this sounds like a retrograde move, a return to the imperatives of close reading, it is not meant to be. Instead, drawing on Hooker's analogy, it is meant to emphasize the epistemological challenges that are endemic to new modes of studying the humanities on a global scale or as a world-wide system. As Hooker demonstrated in his own discipline, these challenges are not simple questions of breadth, size, or countability; they are instead hermeneutical questions that require multiple disciplinary frames and methods to answer, including the interpretive and aesthetic methods in which humanists are trained. While books and plants are not fully interchangeable, ecosystems have certain affinities with world systems of literature. How we perceive those systems and construct their variable scales of study is a question of method that is central to the humanities as it is to the natural sciences, both now and in the nineteenth century.

### Notes

1. See, for example, Pascale Casanova, *The World Republic of Letters*, trans. M. B. Debevoise (Cambridge: Harvard University Press, 2004); and Franco Moretti, *Distant Reading* (London: Verso, 2013).

2. For important contributions to this discussion, see Jane Bennett, *Vibrant Matter: A Political Ecology of Things* (Durham: Duke University Press, 2010); Dipesh Chakrabarty, "Postcolonial Studies and the Challenge of Climate Change," *New Literary History* 43, no. 1 (2012): 1–18.

3. David Palumbo-Liu, Bruce Robbins, and Nirvana Tanoukhi, Introduction to *Immanuel Wallerstein and the Problem of the World: System, Scale, Culture*, ed. David Palumbo-Liu, Bruce Robbins, and Nirvana Tanoukhi (Durham: Duke University Press, 2011), 4. While scale remains an unresolved issue for the humanities, certain scholars have begun to address the problem. Timothy Morton, for example, has explored some of its spatial and temporal dimensions. See in particular *Hyperobjects: Philosophy and Ecology after the End of the World* (Minneapolis: University of Minnesota Press, 2013).

4. Among the many, *many* discussions of scale in the discipline of ecology, see Simon A. Levin, "The Problem of Pattern and Scale in Ecology,"

*Ecology* 73, no. 6 (1992): 1943–67; and Dean L. Urban, “Modeling Ecological Processes across Scales,” *Ecology* 86, no. 8 (2005): 1996–2006.

5. Levin, “Scale,” 1953.

6. Janet Browne, “Biogeography and Empire,” in *Cultures of Natural History*, ed. N. Jardine, J. A. Secord, and E. C. Spary (Cambridge: Cambridge University Press, 1996), 305.

7. Joseph Dalton Hooker, *Himalayan Journals; Or, Notes of a Naturalist in Bengal, the Sikkim and Nepal Himalayas, the Khasia Mountains, &c.*, 2 vols. (London: John Murray, 1854); Joseph Dalton Hooker and Thomas Thomson, *Flora Indica: Being a Systematic Account of the Plants of British India* (London: W. Pamplin, 1855). Hereafter both texts will be cited parenthetically within the text, with shortened titles.

8. Rob Nixon, *Slow Violence and the Environmentalism of the Poor* (Cambridge: Harvard University Press, 2011).

9. Bruno Latour, *Reassembling the Social: An Introduction to Actor-Network-Theory* (Oxford: Oxford University Press, 2005), 186; see also 183–90.

10. Clark describes “scale effects” as the “jumps and discontinuities” between scales that are obscured by smooth in-and-out zooming. “Scale,” *Telemorphosis: Theory in the Era of Climate Change*, vol. 1 (Ann Arbor: Open Humanities Press, 2012), par. 4. Derek Woods offers the phrase “scale critique,” which also captures aspects of Hooker’s thinking, in “Scale Critique for the Anthropocene,” *Minnesota Review* 83 (2014): 133.

11. My use of the word “professional” here is more or less in keeping with our own understandings today. As Jim Endersby has shown, however, the word “professional” was not necessarily how Hooker preferred to have his own work, or person, described. *Imperial Nature: Joseph Hooker and the Practices of Victorian Science* (Chicago: University of Chicago Press, 2008), 21–22.

12. Anne Larsen, “Equipment for the Field,” in *The Cultures of Natural History*, ed. N. Jardine, J. A. Secord, and E. C. Spary (Cambridge: Cambridge University Press, 1996), 358.

13. Joseph Dalton Hooker, *The Rhododendrons of Sikkim-Himalaya*, ed. Sir W. J. Hooker (London: Reeve, Benham, and Reeve, 1849).

14. On Hooker’s collecting and preparation of specimens, see Endersby, *Imperial Nature*, Chapter 2; on Hooker’s ideas about botany as a “philosophical” and “systematic” science, see *Ibid.*, Chapter 9.

15. Janet Browne, *The Secular Ark: Studies in the History of Biogeography* (New Haven: Yale University Press, 1983), 1–57.

16. For an account of Banks’s imperial activities at Kew, see Richard Drayton, *Nature’s Government: Science, Imperial Britain, and the ‘Improvement’ of the World* (New Haven: Yale University Press, 2000), 85–128.

17. On this point, see David Philip Miller, “Joseph Banks, Empire, and ‘Centers of Calculation’ in Late Hanoverian London,” in *Visions of Empire*:

*Voyages, Botany, and Representations of Nature*, ed. David Philip Miller and Peter Hans Reill (Cambridge: Cambridge University Press, 1996), 21–22.

18. Susan Faye Cannon, *Science in Culture: The Early Victorian Period* (New York: Dawson and Science History Publications, 1978), 73–110. See also Michael Dettelbach, “Humboldtian Science,” in *The Cultures of Natural History*, ed. N. Jardine, J. A. Secord, and E. C. Spary (Cambridge: Cambridge University Press, 1996), 287–304.

19. The detailed ideas of Humboldt, de Candolle, Brown, and related botanists on these issues are discussed in Browne, *Secular Ark*, 42–57, and Endersby, *Imperial Nature*, 235–243.

20. Benjamin Morgan, “*Fin du Globe*: On Decadent Planets,” *Victorian Studies* 58, no. 4 (2016): 13.

21. Lorraine Daston, “Type Specimens and Scientific Memory,” *Critical Inquiry* 31 (2004): 153–82.

22. Jen Hill, “Whorled: Cyclones, Systems, and the Geographical Imagination,” *Nineteenth-Century Contexts* 36, no. 5 (2014): 447.

23. At one point, in fact, that indifference led him and his traveling companion into disputed territory in Tibet and a brief imprisonment. See Hooker, *Journals*, 2:190–24.

24. See Gill Saunders, *Picturing Plants: An Analytical History of Botanical Illustration* (Berkeley: University of California Press, 1995), 88–100.

25. Mary Poovey, *A History of the Modern Fact: Problems of Knowledge in the Sciences of Wealth and Society* (Chicago: University of Chicago Press, 1998), 286.

26. On naturalists’ use of familiar Romantic conventions of the sublime and picturesque, see Luciana L. Martins, “A Naturalist’s Vision of the Tropics: Charles Darwin and the Brazilian Landscape,” *Singapore Journal of Tropical Geography* 21, no. 1 (2000): 20; and Lynn Voskuil, “Sotherton and the Geography of Empire: The Landscapes of *Mansfield Park*,” *Studies in Romanticism* 53, no. 4 (Winter 2014): 604–8.

27. Alexander von Humboldt and Aimé Bonpland, *Personal Narrative of Travels to the Equinoctial Regions of the New Continent, During the Years 1799–1804*, 2nd ed., trans. Helena Maria Williams (London: Longman, Hurst, Rees, Orme, and Brown, 1822), 3:36.

28. David Arnold discusses the influence of both Humboldt and Darwin on Hooker’s style in “Envisioning the Tropics: Joseph Hooker in India and the Himalayas, 1848–1850,” in *Tropical Visions in an Age of Empire*, ed. Felix Driver and Luciana Martins (Chicago: University of Chicago Press, 2010), 150–51.

29. David Simpson, “Commentary: Updating the Sublime,” *Studies in Romanticism* 26, no. 2 (1987): 255.

30. Ibid., 246.
31. Mary Louise Pratt, *Imperial Eyes: Travel Writing and Transculturation* (London: Routledge, 1992), 201–8.
32. Edmund Burke, *A Philosophical Enquiry into the Origin of our Ideas of the Sublime and Beautiful*, ed. James T. Boulton (Notre Dame: University of Notre Dame Press, 1958), 72.
33. Emily Brady, “The Environmental Sublime,” in *The Sublime: From Antiquity to the Present*, ed. Timothy M. Costelloe (Cambridge: Cambridge University Press, 2012), 180.
34. Morgan also discusses scales and frames, with great subtlety and nuance, and an emphasis different from mine here, in “*Fin du Globe*,” 613–14.
35. Levin, “Scale,” 1947.
36. Ibid., 1950.
37. Moretti, *Distant Reading*, 67.