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Reverse Hallucinations in the Archipelago

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intercalations 3

The *intercalations: paginated exhibition* series is an experimental foray exploring the structure of the book as a potential curatorial space. As the reader-as-exhibition-viewer moves through the book-as-exhibition, she discovers that the erratic intercalations of the Anthropocene invite new forms of literacy, visibility, inquiry, and speculation that are, in the words of Clarice Lispector, less promiscuous than they are kaleidoscopic.

intercalations is a project of SYNAPSE—The International Curators' Network, published by K. Verlag and Haus der Kulturen der Welt in conjunction with "The Anthropocene Project."

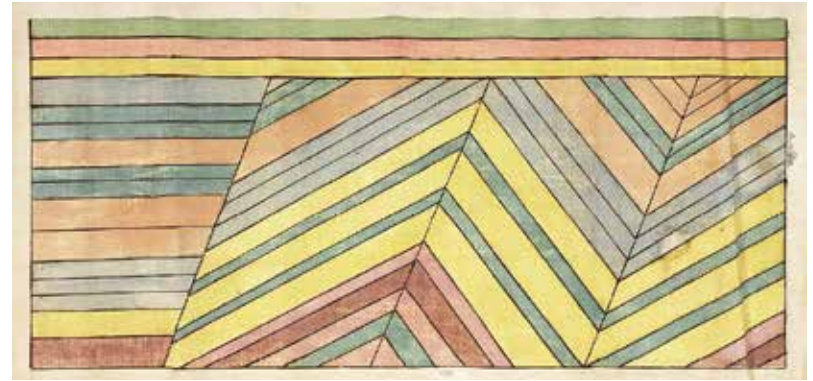
intercalations:
paginated exhibition series

Reverse Hallucinations in the Archipelago unfolds an itinerant encounter with nineteenth-century European naturalists in the Malay world, where the theory of evolution by natural selection emerged alongside less celebrated concerns about mass extinction and climate change; by re-considering the reverse hallucinatory condition of colonial science in the tropics—how scientists learned to not see what was manifestly present—the reader-as-exhibition-viewer may exhume from the remains of this will to knowledge an ethical conviction of particular relevance for confronting forms of neocolonization in the Anthropocene.

Reverse Hallucinations in the Archipelago

co-edited by
Anna-Sophie Springer
& Etienne Turpin

in association with
Kirsten Einfeldt & Daniela Wolf



Orra White Hitchcock, Plate 27, "Strata near Valenciennes," 1828–40, pen and ink drawing on linen, (1 of 61). Courtesy of Amherst College Digital Collections.

Below a surface of three horizontal, uninterrupted layers, six types of sedimentation are seen moving their way up and down in a zigzag and pushing against a nearly horizontal section of differently composed layers situated on the left side of the image. While the two segments are still separated by a thin black line, it seems like a mere matter of time before the erratic layers on the right side of the image infiltrate the more consistent horizontal layers on the left. Born in Amherst, Massachusetts, Orra White Hitchcock (1796–1863) was one of the earliest female scientific illustrators in America. Working with and for her husband Edward, a geology professor, she created hundreds of illustrations of both botanical specimens and geological formations, such as Plate 27, "Strata near Valenciennes." Seen today, Hitchcock's sectional views of soil and rock strata in earthy tones evoke the evenly patterned artworks of twentieth-century artists Anni and Josef Albers.

In the vocabulary of geology, the proper term for one type of rock being pushed in-between other stratified segments is an "intercalation." With reference to its Latin etymology, the word literally means something like "being inserted between an existing 'proclamation'"—or, something that has been understood as of official, and of great importance, is changed because of a new layer or element having entered the reified sequence. In contrast to hard rock, the stuff of narrative is softer and more

malleable to begin with. Nevertheless, in a novel, the work of weaving one story into another shares the eponymous, albeit literary term, “intercalation.” In the wake of the Anthropocene hypothesis—which, at least in part, contends that anthropogenic sedimentations are transforming previous geological compositions in literally fundamental ways—the intercalating of existing “stories” and “official proclamations” with transformative and erratic new layers seems of particular urgency.

Inspired by Orra White Hitchcock's dynamic line drawings and a polysemic concept that sits comfortably, if at times erratically, in both earth science and the humanities, the *intercalations: paginated exhibition* series developed for the SYNAPSE International Curators' Network by Anna-Sophie Springer and Etienne Turpin seeks to engage with entangled relationships and habitual distinctions in order to reimagine traditional fields of knowledge within the unstable context of the Anthropocene. When explored as *intercalations*, the presumably dialectical categories of nature and culture, human and non-human, subject and object, fact and fiction become transitional, layered narratives with porous, permeable, and shifting boundaries.

Dear Reader-as-Exhibition-Viewer,

Reverse Hallucinations in the Archipelago explores the legacies of colonial science in Southeast Asia, asking how to meaningfully re-calibrate the natural histories of the Malay Archipelago in our era, which some have called the “Plantationocene.” In dealing with various natural history collections from Indonesia, this book has become its own singular collection. It gathers a series of contributions into a novel constellation that reflects on the Malay region and concepts of its “nature” within the context of the birth of modern biology and tropical agriculture, as well as colonial resource extraction and the collection of scientific specimens. How can *the narratives of travel and studies of man and nature* by nineteenth-century European naturalists be transformed when reframed through contemporary Indonesia's socio-ecological dilemma of land grabbing and habitat destruction from extensive deforestation, peat fires, and the apparently endless monoculture plantations spreading across the archipelago? As Anna Tsing has said, “staying alive—for every species—requires livable collaborations.” Engendering a multidisciplinary conversation across science, art, and activism, *Reverse Hallucinations* maps some productive confrontations and livable, exuberant alliances capable of addressing climate change and mass extinction.

Whereas a hallucination allows us to see something that isn't *really* present, we introduce the concept of *reverse hallucinations* in our opening essay, “The Science of Letters,” in order to call attention to the phenomenon of *not seeing—or willing not to see*—what is manifestly present as the consequence of scientific inquiry. Our text considers the histories of scientific publications and personal letters sent from Southeast Asia by Franz Wilhelm Junghuhn, Alfred Russel Wallace, and Ernst Haeckel in order to discern a *schizoscopic* parallax at the perceptual core of the colonial-scientific project.

Musician and anthropologist Rachel Thompson contributes a two-part composition relaying the Javanese osteo-mythology of the Dutch paleoanthropologist Eugène Dubois, a one-time student of Haeckel. Hypothesizing that the so-called “missing link” in the evolutionary chain between the great apes and the human species could be exhumed somewhere in Indonesia, Dubois dug around in river beds and volcanic rock layers on

Java until, in 1891, he indeed excavated a set of sensational fossils known as the Trinil skullcap and thighbone of “Java Man.” Written in a uniquely lyrical style, Thompson’s contribution vividly weaves together her own experiences of archival research in Indonesia and the Netherlands with historical incidents from Dubois’s expedition and eccentric scientific biography. The result is a compelling narrative about the mnemonic charge and semantic evolution of specimen collections as they outlive their creators.

Entomologist George Beccaloni, Director of the A.R. Wallace Correspondence Project, paints a picture of Wallace’s atypical persona while illuminating the historical circumstances of the naturalist’s Malay expedition and the resulting formation of evolutionary biology as a scientific field. Wallace once suggested “that in all tropical countries colonised by Europeans the most perfect collections possible in every branch of natural history should be made and deposited in national museums,” as a means to secure scientific knowledge of nature against its annihilation by those same colonial governments. In contrast, Beccaloni discusses the challenges of doing scientific field work in our current epoch, which he calls the “Destructocene.”

In a collage of images and texts, artist and founder of the Migrant Ecology Project Lucy Davis describes the process of combining DNA-tracking and oral histories to retrace the paths of 1930s teak furniture from Singapore markets to Indonesian plantations in Southeast Sulawesi. The piece journeys through the region’s history of colonialism, resource extraction, timber harvesting, and financialization, while experimenting with artistic methodologies that literally reanimate the stories’ matter and the matter’s stories, from their ligneous components to their spiritual elements.

Sulawesi is also the geographical focus of an interview with geologist Satrio Wicaksono and its attendant interlude by climate scientist and evolutionary biologist James Russell. In their respective contributions about the Towuti Drilling Project (TDP), they each reflect on the processes of obtaining lake-bed drill cores on site and then scanning and analyzing them in the lab to understand the deep-time transformations of the so-called “Wallacea” region. Four fascinating core scan reproductions convey a sense of Nusantara’s diverse soil histories and ecological past while

also giving a glimpse of the thousands of similar images the TDP team are currently evaluating.

The second part of Rachel Thompson’s essay produces curious reverberations here, when we learn about Dubois’s obsession with the paleo-climatological history of the Netherlands. Thompson describes how, towards the end of his life, he attempted to reverse-engineer the flora on his own property as “a monument to the past through the recreation of a landscape in which early man lived in close harmony with the environment.”

Photographer Fred Langford Edwards presents a small selection of works from his expansive middle-format series documenting the insects, skeletons, skins, and taxidermy animals, which contemporary museum curators count among the 125,660 specimens of natural history that Wallace collected during his Malay expedition from 1854 to 1862. Working with Edwards during previous exhibitions, and discussing how artistic practices of documentation can shape how we deal with the inheritance of collections such as these, has been a continuing influence on our research, writing, and exhibition making.

In 2015, artist and hacker Geraldine Juárez also participated in our exhibition *125,660 Specimens of Natural History* at Komunitas Salihara in Jakarta, with a project that copied and reprinted the entire digitalized collection of the Museum Nasional of Indonesia as it has been incorporated into the Google Cultural Institute’s endeavor to create a complete collection of the world’s museums. We are excited to publish a revised and significantly expanded version of Juárez’s initial research in this volume; articulated between two distinct voices, the text urges us to recognize the neocolonial dynamic unfolding as the giants of platform-driven capitalism reproduce museums as databases, turning their contents into pixels arranged to ensure the corporate monetization of culture.

Remaining in the register of data and pixels, a series of aerial drone photographs produced by Radjawali Irendra’s Akademi Drone Indonesia helps document some of the more recent transformations of forest landscapes in Nusantara. The scale and impact of local habitat destruction is also the subject of an original translation of a text by Matthias Glaubrecht, Scientific Director of the University of Hamburg’s Center for Natural History (CeNak), which outlines the maddening rate of species extinction in the

rapidly transforming Malay world. An interview with Zenzi Suhadi, Head of the Department of Research, Advocacy, and Environmental Law at the Indonesian Forum for the Environment (WALHI), adds a perspective from the ground, detailing the environmental and economic violence perpetuated by the expansion of the palm oil industry in Indonesia, currently the world's largest crude palm oil producer and exporter. The book concludes with a science fiction graphic novella by Mark von Schlegell, Iwank Celenk, and SLAVE PIANOS (with Punksasila) about a futurist entomological meltdown achieved by extraterrestrial moths setting out from Indonesia to decolonize Australia.

Intercalated throughout the book are reproductions of images from the photo collection of the Buitenzorg Botanical Garden—once Southeast Asia's foremost institute for botany and agricultural research. We were introduced to this archive in 2015, when collaborating with the Biology Research Center of the Indonesian Institute of Science for the exhibition *125,660 Specimens of Natural History*. Here, we remain indebted to Rosichon Ubaidillah, head of Zoology Section at Museum Zoologicum Bogoriense, and his wonderful colleagues in Cibinong, Indonesia, for their advice and support, as well as for the opportunity to share these archival images.

Likewise, our gratitude extends to everyone who made this book possible. We thank all the contributors for sharing their research, projects, and perspectives in this volume. We are grateful to Kirsten Einfeldt and Daniela Wolf from the Haus der Kulturen der Welt for founding and coordinating the SYNAPSE International Curators' Network (from 2011 to 2016) and inviting us, together with Bernd Scherer, to develop *intercalations*. The project would not exist without the generous support of the Schering Stiftung, and here we are again indebted to Heike Catherina Mertens for her ongoing mentorship and support. We thank Lucas Freeman for transcribing and copy editing our interviews; Alifa Rachmadia Putri and Widya Aulia Ramadhani for providing translations during conversations with our Indonesian interlocutors; Martin Hager and Jeffrey Malecki for their meticulous attention as copy editors; and Louis Steven for administrative and proofreading support. A very special thanks to Katharina Tauer, the designer of this series, for her incredible commitment, enthusiasm, patience, and openness to experiment with us while

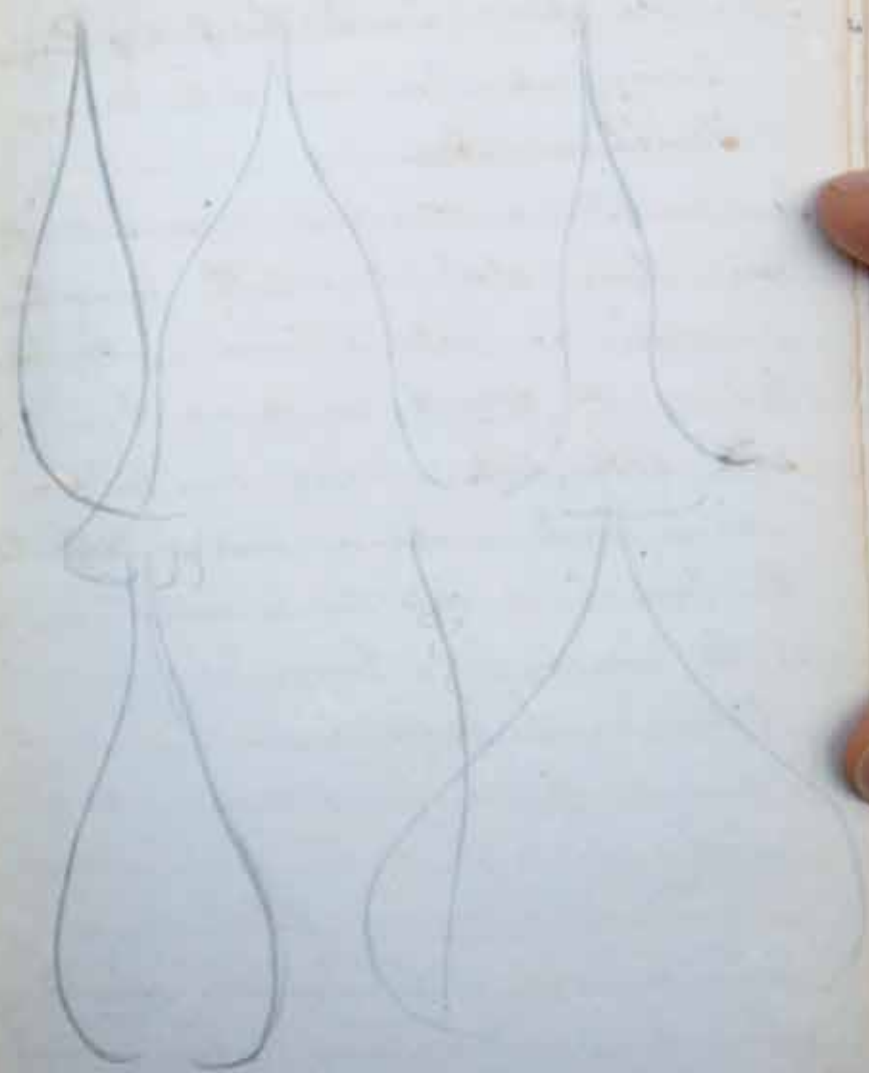
creating this work together over the past three years. This volume would not have been possible without the support, encouragement, advice, and friendship of many people along the way, and we are especially grateful to Bergit Arends, Franz Xaver Augustin, Ute Meta Bauer, Andrew Berry, Annette Bhagwati, Benjamin H. Bratton, Lindsay Bremner, Lynda Brooks, Giulia Bruno, Shannon Castleman, Elaine Charwat, Roger Conover, Nirwan Dewanto, Thom van Dooren, Sigrid Espelien, Anita Eylmann, Leah Gibbs, Jason Groves, Asikin Hasan, Tomas Holderness, Wolfgang Hüchel, Elise Hunchuck, Radjawali Irendra, Eben Kirksey, Charles Leh, Armin Linke, Dian Ina Mahendra, Darren Mann, Ho Tzu Nyen, Ening Nurjanah, Richard Pell, Fandi Rahman, Farid Rakun, Alessandra Renzi, Robert Zhao Renhui, John Paul Ricco, Chris Russill, Basuki Santoso, Felix Sattler, Mark von Schlegell, Katrin Sohns, Rukka Sombolinggi, Andrew de Sousa, Susan Schuppli, Frank Steinheimer, Renate Sternagel, Zenzi Suhadi, Paulo Tavares, Caleb Waldorf, Eyal Weizman, the Indonesian Forum for the Environment (WALHI), the Indonesian Institute of Science/Museum Zoologi Bogoriense (LIPI/MZB), the Goethe-Institut, and all the members of the SYNAPSE International Curators' Network. As the publication of this book also occurs between the two major exhibition cycles of our ongoing *Reassembling the Natural* project, we would like to thank all of the contributors, advisors, assistants, artists, and scientific curators who have worked with us in Indonesia and are working with us now toward the realization of *Verschwindende Vermächtnisse: Die Welt als Wald*, premiering at the Zoological Museum, CeNak, University of Hamburg, in November 2017. Without the generous support and friendship of so many allies and co-conspirators, this book would never have (finally!) made it to print.

Selamat membaca buku itu!

Anna-Sophie Springer & Etienne Turpin
Berlin & Jakarta, February 2017

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Formation of a complete Library of Nat. Hist.

That such does not exist is demonstrable to Naturalists. It is proposed that the chief Nat. Hist. Societies (Linnean, Zoological & Entomological) should, while keeping their libraries distinct, have them under one roof in adjoining rooms & under the care of one Librarian. Members of all the Societies to have free use of all in the library, duplicates only to be taken out, except by members of the Soc. to which the work belongs & then only for ~~very~~ short periods & on leaving a deposit of ^{the} value of each work. Saving of Expense in rooms & Librarian to be spent on Books, each adding works in its own department. To such a joint library many expensive works would be given by foreign governments which could not be afforded to ea. of the three.



Mid-tail feathers of Ardea herodias a pair in position in various examples -

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The Science of Letters

by Anna-Sophie Springer
& Etienne Turpin

The Apparency of Evidence

It cannot be said that the matters of science are uncertain just because they abound with quarrels and controversies.

— Spinoza, *Ethics*, 1677

This essay considers how the ethical and epistemological confusions apparent in the private reflections of European naturalists of the nineteenth century suggest an alternative history of colonial science and its long-presumed positivist trajectory. By attending to some lesser-known letters, exchanges, notebooks, and ephemera found among the well-ordered annals of natural history, our aim is to delineate a *minor history of uncertainty*. This attempt is not simply a matter of correcting the historical record, nor is it an effort to exonerate those responsible for developing or implementing typically violent programs of colonial expansion, whether by way of cartography, collections, or other means of empire and publicity. Instead, by mapping a minor history of uncertainty throughout the Indonesian archipelago, and by traversing the torrid zone alongside several figures in pursuit of new knowledge to bring back to Europe, our aim is to trouble an *image of science* which continues to obstruct environmental justice in the



present.¹ Simply put, we believe that the enduring image of science as an enterprise committed to a positivist clarification of knowledge through the elimination of any ethical friction or moral doubt subverts contemporary climate change science and related inquiries into biodiversity loss, mass extinction, and planetary toxicity.

Before we consider European expeditions in the Indonesian archipelago and the various expressions of the will to knowledge which these journeys reified in the history of science, it is necessary to recount three more recent events that further clarify the stakes of this history by exposing its pernicious if difficult-to-discern legacy.

17 November 2009. In anticipation of the United Nations Climate Change Conference (UNFCCC) set to be held in Copenhagen, Denmark, in December 2009, the servers of the Climate Research Unit at the University of East Anglia in Norwich, England, were attacked. Hackers copied thousands of files, documents, and emails, then leaked them to various internet sites for global distribution and commentary. The suggestion that the hack exposed evidence of falsified climate data—thus proving climate change was an orchestrated conspiracy—was thoroughly promoted by climate denialists, including James Delingpole, executive editor for the London branch of the Breitbart News Network, who first named the incident “Climategate.” That far-right extremist, white supremacist, and conspiratorial media outlets could so thoroughly leverage the incident to suggest that there was no scientific consensus on anthropogenic climate change certainly requires

1 On the philosophical consequences of such “images,” and the “image of thought” in particular, see Gilles Deleuze, *Difference and Repetition*, trans. Paul Patton (New York: Columbia University Press, 1994), 129–67.

further discussion; however, our concern in this essay are the latent assumptions about scientific consensus that the hack revealed.² If the publics who read about it online or in the mainstream press, or saw it televised on cable news networks, had a greater appreciation for the subjective uncertainties that constitute the real work of science, instead of the positivist image of decisive objectivity, would there have been a controversy at all? Even when we admit the role played by climate denialists in falsely extrapolating scientific conspiracy theories from the hacked data of the Climate Research Unit, it is evident that non-scientific communities could be better inoculated against such flagrant falsehoods if they shared a more sensitive and dynamic image of science. Which is to say: a post-positivist image of science wherein uncertainty on one stratum does not prevent consensus on another would be an essential component of the aesthetics of evidence in the Anthropocene.³

22 April 2017. From the March for Science homepage: “In more than 600 cities around the world, we marched as an unprecedented coalition of organizations and individuals. We marched because science is critical to our health, economies, food security, and safety. We marched to defend the role of science in policy and society.”⁴ It is essential to acknowledge that the need to “march for science” in 2017 might have seemed

2 On the dangers of disinformation strategies like those related to “Climategate,” see Alice Marwick and Rebecca Lewis, *Media Manipulation and Disinformation Online* (New York: Data & Society Research Institute, 2017).

3 On the “aesthetics of evidence,” see Eyal Weizman et al., eds., *Forensis: The Architecture of Public Truth* (Berlin: Forensic Architecture and Sternberg Press, 2014) and Eyal Weizman, *Forensic Architecture: Violence at the Threshold of Detectability* (New York: Zone Books, 2017). For a discussion of climate data friction, see Paul N. Edwards, *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming* (Cambridge and London: MIT Press, 2010).

4 March for Science, <https://satellites.marchforscience.com>.

unnecessary were it not for the inauguration of the new President of the United States, Donald J. Trump, in January of the same year. That “science,” as a mode of inquiry, now requires public demonstrations in a manner that was until very recently the purview of social movements is a rather startling indicator of the apparenity of evidence in the era of Trump.⁵ While the Trump White House promoted homegrown “alt-truths” on issues from U.S. health care and taxation to veterans affairs and missile launches, the disconcerting deletion of climate change information and related public data sources from government websites also helped to draw hundreds of thousands of marchers around the world into the streets. “What do we want? Evidence-based policies! When do we want them? After peer-review!” Amidst these unprecedented calls for the protection of a properly scientific evidentiary, what post-positivist image of science can we help co-produce? How can we help ensure that the various pro-science reactions to Trump-era attacks avoid simply reifying an image of science that undermines broader but no less urgent questions about epistemological diversity, knowledge co-production, and the social and environmental consequences of techno-scientific endeavors under capitalism?⁶

17 February 2017. As Scott Pruitt assumed his duties as the 14th Administrator of the Environmental Protection Agency (EPA) of the United States of America, the fact that as Attorney General of Oklahoma he sued the EPA no fewer

5 Robinson Meyer, “Donald Trump Is the First Demagogue of the Anthropocene,” *The Atlantic*, 19 October 2016, <https://www.theatlantic.com/science/archive/2016/10/trump-the-first-demagogue-of-the-anthropocene/504134>.

6 Regarding epistemological diversity, see especially Boaventura de Sousa Santos, ed., *Another Knowledge Is Possible: Beyond Northern Epistemologies* (London and New York: Verso, 2008).

than fourteen times was not lost on America's scientific community. The EPA was established in 1970 under an executive order from then-U.S. President Richard Nixon, who saw the agency as a necessary extension of the federal government that could help to protect human and environmental health. That Trump would appoint a known climate skeptic and long-time industry advocate to head the EPA signaled, in no uncertain terms, that the agency would be thoroughly dismantled both in terms of providing evidence-based policy, as well as upholding environmental legislation such as the Clean Air and Clean Water Acts. How, when facing such a severe attack on the scientists and their ability to shape policy through research (not to mention attacks on research funding and global research collaborations), can a history of ethical *uncertainty* contribute to the self-defense of human and nonhuman worlds?

Indeed, as climate change studies warn persistently of devastating trajectories for human and nonhuman worlds alike, the Trump administration's disposition toward scientific research makes the current essay particularly *untimely*. In this moment of anti-science (as well as industry-backed non-science, which has attempted to undermine the integrity of public debate at least since the end of WWII), alt-truths, and accelerating climate change, is it not more important than ever to rally behind an image of science as an objective, incontrovertible, collective human endeavor? While we acknowledge the increasing acrimony of this *apparent* debate as well as ongoing disputes between scientists and industry-backed researchers who intentionally create doubts about valid scientific findings, we nevertheless believe that to be drawn uncritically into such a binary weakens the power of collectives and communities to respond effectively to attacks on their neighborhoods, their

health, and their variously constituted worlds.⁷ Neither Trump, nor Pruitt, nor their climate change-denying supporters will be defeated by a neo-positivist image of science because their matters of concern are not scientific; instead, what is at stake is *power*.⁸ And, in the struggle against racist, populist State-capitalism, its environmental violence, and its life-threatening externalities which have been aggregating together in the atmosphere since the beginning of the industrial revolution as planetary climate change, a more powerful science is definitely not one still tricked by a positivist promotional campaign. In his remarkable essay on the scientist and engineer S.V. Seshadri, historian Shiv Visvanathan emphasizes the need to transform the work of science itself, "to create a science that thought with its hands, a science that was more sexual and sensual, a science that was sensitive to suffering."⁹ This, in our estimation, is a science at once worth fighting for and worth fighting with; indeed, many examples of lithe, scientific practices are now proliferating as the pressures for communities to defend themselves from the ravages of capitalism become ever-more acute.¹⁰

7 On the alleged debate over climate science and its profitable manufacture, see Naomi Orestes and Erik M. Conway, *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming* (New York: Bloomsbury Press, 2010); on worlds and worlding, see Déborah Danowski and Eduardo Viveiros de Castro, *The Ends of the World* (Cambridge: Polity Press, 2017).

8 Again, see Orestes and Conway, *Merchants of Doubt*.

9 Shiv Visvanathan, "Between Cosmology and System: The Heuristics of a Dissenting Imagination," quoted in Heather Davis and Etienne Turpin, eds., *Art in the Anthropocene: Encounters Among Aesthetics, Politics, Environments and Epistemologies* (London: Open Humanities Press, 2015), 18. See also Bruno Latour and Vincent Antonin Lépinay, *The Science of Passionate Interests: An Introduction to Gabriel Tarde's Economic Anthropology* (Chicago: Prickly Paradigm Press, 2010).

10 See Mary Ellen Hannibal, *Citizen Science: Searching for Heroes and Hope in an Age of Extinction* (New York: The Experiment Publishing, 2016), and Kath Weston, *Animate Planet: Making Visceral Sense of Living in a High-Tech Ecologically Damaged World* (Durham: Duke University Press, 2017).

In what follows, we develop a minor history of uncertainty as a way to help describe what is at stake in the suppression of non-positivist scientific sensitivities. To reanimate a sensitive science for the Anthropocene, the colonial image of science that still represents the will to knowledge as a triumphalist suppression of doubt must also be decolonized; again, this is no strategy of exoneration, but rather the necessary overcoming of a powerful image of science that not only weakens our sensitivities in the present, but that *never really was*.

In the intellectual shadow of scientific papers, which can only ever announce the confident findings of an objective mode of inquiry, we find so many other letters and notebooks that declare, sometimes emphatically and often in confused or ambiguous terms, an altogether different affect. When we pay closer attention to these uncertainties, it becomes clear that even the most confident figures in the pantheon of modern science flinched when considering the ethical implications of their work. As a man of social rank with deep connections to the Church of England, Charles Darwin hesitantly pondered the danger of his ideas about evolution; inevitably, he was aware of the potential accusations of heresy his work might solicit from his fellow Victorians, confident as they were about the unity of nature wherein every creature purposefully inhabited its position within God's unchanging master plan. Fifteen years before he would agree to publishing *On the Origin of Species* (1859), Darwin admitted his bad conscience about "presumptuously" believing in species' mutability to his colleague Joseph Hooker with the parenthetical remark: "(it is like confessing a murder)."¹¹ While

11 Charles Darwin letter to J. Hooker, 11 January 1844, <http://www.darwinproject.ac.uk/entry-729>; see also Ralph Colp Jr., "Confessing a Murder: Darwin's First Revelations about Transmutation," *Isis* 77, no. 1 (March 1986): 8–32.

Darwin's concern over the consequences of his ideas were well-founded, the history of scientific letters suggests this comportment is less of an aberration than it might appear in the textbook accounts of the *Great Men of Science*. In fact, nagging doubts about the ethics and implications of scientific research were a psychological condition familiar among the colonial explorers and naturalists of the nineteenth century. But, if Darwin's concerns were keyed to the metaphysical structure of Victorian life, the will to scientific knowledge in the colonial tropics raised a different set of vexing questions about the environmental consequences of their inquiries.

Michel Foucault, a philosopher more attentive to systems of thought than perhaps any other in the twentieth century, once explained that the objective of philosophy "is to render visible precisely what is visible, that is, to make appear that which is so near, that which is so immediate, so immediately bound to ourselves that we for that very reason do not perceive it."¹² In this estimation, "if the role of science is to make known that which we don't see, the role of philosophy is to make us see what we see."¹³ While these two objectives are present among the trajectories of the will to knowledge that Foucault describes in his inaugural lecture course at the Collège de France, it is another, more ambivalent mode of evidence that we discover in circulation among the letters of colonial naturalists in the Indonesian archipelago.¹⁴ If philosophy renders visible what had been too visible to see, and science brings to

12 Michel Foucault, quoted in William Haver, "A Sense of the Common," *The South Atlantic Quarterly* 111, no. 3 (Summer 2012): 450–51.

13 Ibid., 451.

14 Michel Foucault, *Lectures on The Will to Know: Lectures at the Collège de France 1970–1971 and Oedipal Knowledge*, ed. Daniel Defert, trans. Graham Burchell (London: Palgrave MacMillan, 2011).

light what was previously beneath the “threshold of detectability,”¹⁵ *hallucinations* are a part of that curious brand of revelation which weaves together the seen and unseen by way of spectacular, networked patterns of incorporeal connectivity.¹⁶ Among the European dropouts who elected to find their fame and fortune on the shores of faraway colonies, we discover the precise inversion of this revelatory phenomenon. Instead of iridescent connections mending together the dimensions of apparent and latent reality, the perceptions of colonial scientists are blurred by the recurrence of “reverse hallucinations”—an expression borrowed from William Gibson by way of Ricardo Dominguez—which occasion events of *not seeing what is manifestly present*. Let us now turn to the torrid zone in the nineteenth century, where we will quickly discover how the colonial segregation of subjective, ethical life from the objectivity-oriented will to scientific knowledge both encouraged and relied upon *reverse-hallucinatory* discrepancies between the obvious and the obscure.

15 Weizman, *Forensic Architecture: Violence at the Threshold of Detectability*.

16 For a compelling survey of the “incorporeal” in European philosophical thought, see Elizabeth Grosz, *The Incorporeal: Ontology, Ethics, and the Limits of Materialism* (New York: Columbia University Press, 2017).

Colonial Contours

You are free to conjure up an ecology, a demography, and a geography that would be most favorable to the state and its ruler. What, in those circumstances, would you design?

—James C. Scott, *The Art of Not Being Governed*, 2010

Among its vast collection, the Staatsbibliothek zu Berlin (State Library of Berlin) contains an original map of the geology of the island of Java, published by Franz Wilhelm Junghuhn (1809–1864) in 1855. To view this, the first comprehensive map of the world’s most populated island, visitors can request an appointment online. After waiting several weeks, and upon arriving at the library’s Maps Collection, it is then possible to unfold a three-meter-long rendering of Java across several pristine library tables. The quality of the production is compelling, awesome even. In a world dominated by Google Earth and its military-grade resolution, the achievements of this mid-nineteenth-century map are still irreproachable. The Perpustakaan Nasional di Indonesia (National Library of Indonesia) in Jakarta also contains an original of Junghuhn’s map, albeit the section profile included in the first volume of his publication *Java, seine Gestalt, Pflanzendecke und innere Bauart*, published in 1852. Extending 153 centimeters, this fold-out illustration depicts all of the Indonesian island’s peaks, arranged from west to east across its 1,000-kilometer length, at a ratio of 1:18.25.

In Berlin, in order to view the map visitors must leave behind their ink pens upon entering the research room. Inside, they must wear a pair of white flannel gloves to further protect this precious document of colonization—heralded among historians of cartography as a remarkable achievement—from any

human damage. In Jakarta, the tome containing the section map is passed over the librarian's counter; opening it to reveal the century-old lithograph, visitors are confronted with numerous moldy stains, perpetually conjured by the tropical humidity. The precarious state surely points to a lack of institutional funding that would be necessary to preserve this century-old paper stock; but, when the map begins to crumble as it is unfolded for viewing, its efficacy as a colonial tool of power comes into question. What does it mean to witness the decay of such a document in the place it once served to conquer? The history of Junghuhn's map and its attendant socio-spatial consequences helps to trace the colonial contours that enabled the island of Java to become fully addressable by its European occupiers. Because any cartographic addressability ultimately expedites forms of violence typical of both historical and contemporary imperialism, such endeavors must be understood as part of the colonial will to science that renders legible and measurable the entangled territories of tropical life.¹⁷

While various other cartographers attempted to capture Java's contours before and during the six years in which Junghuhn produced his *Javakaart*, these efforts were typically based on an awkward assemblage of incomplete fragments. What distinguishes Junghuhn's survey is the fact that he was the sole cartographer to chart the horizontal expanse of the island in its entirety. As a lover of the region's high altitudes, he achieved this total and totalizing image by climbing nearly all of Java's peaks in order to measure and triangulate the distances among the mountains in relation to two astronomically

17 For a unique reading of such entanglements, see Eben Kirksey, *Freedom in Entangled Worlds: West Papua and the Architecture of Global Power* (Durham: Duke University Press, 2012).

determined points on the northern coast of Java, in the cities of Batavia and Surabaya. He could then extrapolate their latitude and longitude in relation to Greenwich, England. In addition to using compasses and a sextant, he employed a barometer, which helped him to measure atmospheric pressure and thus altitudes with extraordinary accuracy.¹⁸

The stunning precision of Junghuhn's maps revolutionized geological and geographical knowledge of Java, then the most important island in the most important colony occupied by the Netherlands: more than a century would pass before these maps required any significant updating through modern cartographic means.¹⁹ According to historian Renate Sternagel, Junghuhn was ensnared in a contradictory position, pitting the ambitions of his colonial employers against his own, formidable Romantic ambition for personal freedom: "As a natural scientist Junghuhn loved untouched nature, the 'wilderness,' and hated 'civilization'."²⁰ At the same time, through his work as surveyor and collector, "he embodied [...] the ideal of the progressive-thinking colonial explorer, who played his part in taking measurements of the world, as a forerunner for soldiers and planters."²¹ It is worth emphasizing that, at least in the context of scientific endeavor, the cartographic will to knowledge coincides almost exactly with the colonial will to power. As in many other cases, the map of Java served as an "imperialist weapon,"

18 Gerhardt Aust, "Junghuhn als Landvermesser und Kartograph," *Forschen, Vermessen, Streiten: Franz Wilhelm Junghuhn (1809–1864)*, ed. Goethe-Institut Jakarta (Berlin: Regiospectra Verlag, 2010), 103–05. Unless otherwise noted, all translations from German are by Anna-Sophie Springer.

19 *Ibid.*, 108.

20 Renate Sternagel, quoted in Goethe-Institut Jakarta, *Forschen, Vermessen, Streiten: Eine Ausstellung zum 200. Geburtstag des Java-Erforschers Franz Wilhelm Junghuhn (1809–1864)*, exhibition catalog (Jakarta: Goethe-Institut, 2009), 26.

21 *Ibid.*

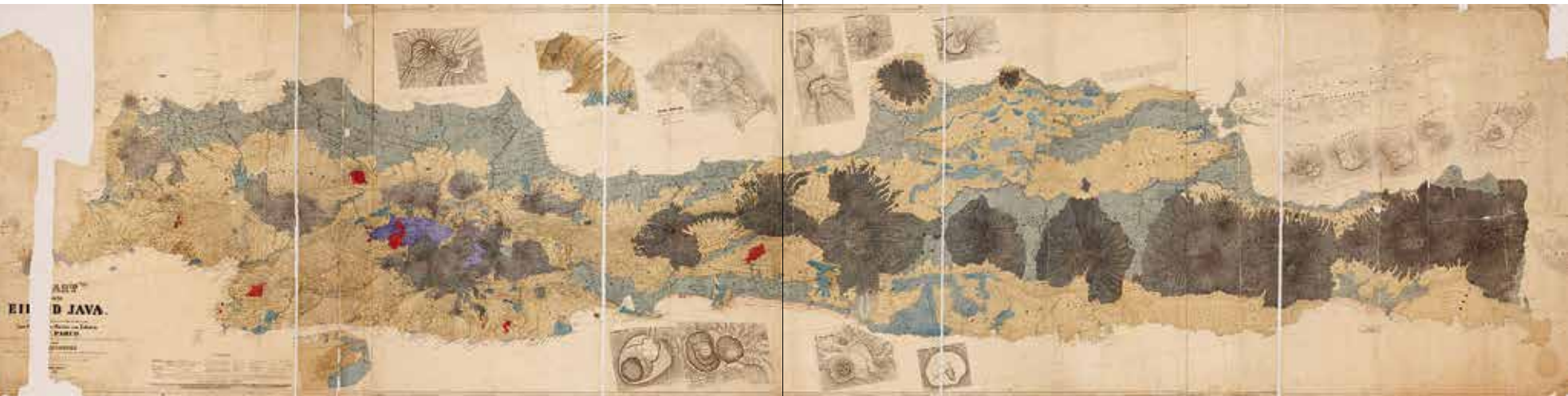


Fig. 02. F.W. Junghuhn's "Kaart van het Eiland Java." Breda: A.J. Bogaerts, 1855. Scale 1:35,000; format 79 × 308 cm. Courtesy of the Staatsbibliothek zu Berlin—Preußischer Kulturbesitz.

determining friends and enemies among those mapping and those being mapped.²² To fulfill the orders of his employer, the Ministry of the Colonies, Junghuhn notably included in his exceptional representation depictions of the coal repositories recently discovered along the southern coast, as well as detailed information about the island's other valuable mineral deposits.²³ To fully dominate this island and its subsurface riches, however, it would first need to be more thoroughly addressed.

The ambition to control a territory for the purpose of extracting wealth from its human and nonhuman inhabitants has been realized according to several characteristic maneuvers, not least of which is the assignment of an address to those elements subject to control, particularly subjects necessary for processes of capital accumulation. Historian James C. Scott and theorist Benjamin H. Bratton have described the processes associated with coercive legibility and involuntary addressability, respectively, both of which help us understand more fully the role of island cartography within the insurrectionary landscape of the Dutch East Indies during the nineteenth century.

In his account of legibility and simplification as trajectories of governance, Scott describes the difference between a European medieval city or a Middle Eastern *medina* and a gridded city like Daniel Burnham's Chicago or Georges-Eugène Hausmann's Paris. While the former "enjoys at least a small measure of insularity from outside intrusion," for the latter, "[t]he knowledge of local citizens is not especially privileged

vis-à-vis that of outsiders."²⁴ For Scott, these settlement patterns suggest cognitive or epistemic islands. Describing medieval Bruges, he writes: "Illegibility, then, has been and remains a reliable resource for political autonomy."²⁵ As authorities attempted to render territories governable, they aimed to make them and their populations legible through mechanisms including, but not limited to, surnames, cadastral maps, and traffic management. The question of how to address a subject of power is consistently answered through this visual economy of politics. Or, as Scott makes even more explicit, "modern statecraft is largely a project of internal colonization, often glossed, as it is in imperial rhetoric, as a 'civilizing mission'."²⁶

Bratton has recently updated this logic for the twenty-first century in his book *The Stack*.²⁷ For him, the long arc of legibility—from surnames to street addresses, postal codes to TCP/IP protocols—has helped produce an "accidental megastructure." He contends that, instead of seeing all of these elements of planetary computation as "a hodgepodge of different species of computing, spinning out on their own at different scales and tempos, we should see them as forming a coherent and interdependent whole. These technologies align, layer by layer, into something like a vast, if also incomplete, pervasive if also irregular, software and hardware *Stack*."²⁸ Comprised of six autonomous yet interdependent layers—Earth, Cloud, City, Address, Interface, User—the Stack centrifugally spins out consequences

22 On the relationship between cartography and power, see J. B. Harley's classic essay "Maps, Power Knowledge," in *The Iconography of Landscape*, ed. Denis Cosgrove and Stephen Daniels (Cambridge: Cambridge University Press, 1988), 277–311.

23 Ritter Göpperts, "Bericht über die Sammlungen des Herrn Junghuhn aus Java" in *Monatsberichte über die Verhandlungen der Gesellschaft für Erdkunde zu Berlin* (1851): 149–50.

24 James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998), 54–6.

25 *Ibid.*, 54.

26 *Ibid.*, 82.

27 Benjamin H. Bratton, *The Stack: On Software and Sovereignty* (Cambridge, MA: MIT Press, 2015), esp. 120, 191–218, 333.

28 *Ibid.*, 5.

in every direction and dimension. For our purpose, it is Bratton's thinking about addressability that helps frame the stakes of Junghuhn's colonial cartographic heroism, suggesting its relevance for a contemporary reconsideration of the concept of the island as such. Like Scott's discussion of legibility and simplification, Bratton's layer of address within the Stack identifies various means by which data (and their socio-spatial consequences) are measured and classified as a means for their governance. Contrary to the popular belief in a free and fluid internet, legibility-cum-addressability is even more consequential as the morphology of sovereignty increasingly exhibits dematerializations, virtualizations, physical reassertions, and material instantiations, that is, as politics are simultaneously rendered through a transformative logic of software. But, as Bratton argues, this transition is not only a matter of interfaces or parameters; the power of addressability as a modality of governance reaches back at least to the cartographic trajectory that subtends the colonial-scientific will to knowledge.²⁹

However, in order to understand the project of mapping Java, it is necessary to first recall the unstable landscape of the nineteenth-century Dutch East Indies, a site of struggle already punctuated by centuries of revolt against European occupation. The Javanese Prince Diponegoro is portrayed—famously or infamously, depending on one's affinities for rebellion—as the arrested figurehead of the guerilla revolts that terrified Dutch rulers on Java in the 1820s.³⁰ As the colonial government

29 Thanks to Benjamin for an insightful conversation about addressability during our "A Natural History of the Stack" workshop at the Strelka Institute for Media, Architecture, and Design in Moscow earlier this year.

30 See, for example, Raden Saleh's iconographic *Penangkapan Pangeran Diponegoro* (*The Arrest of Prince Diponegoro*) of 1857, which depicts the 28 March 1830 betrayal and arrest of Diponegoro by the Dutch Lieutenant General Hendrik Merkus de Kock.

repeatedly failed to prevent plague and famine across the island, which had allegedly been placed under European rule in order to improve the stifling human conditions suffered by native inhabitants, anticolonial sentiment became pervasive.

As historian Gerhardt Aust observes, the strategic importance of reliable maps for the Dutch military was given particular urgency by the events of the Java War (1825–1830), when due to insufficient geographical and topographical knowledge, the colonial army suffered significant losses against Diponegoro's guerillas.³¹ The rebellion was the largest organized uprising against the Dutch since they had first colonized the island in the early seventeenth century. Under the leadership of the guerilla-prince from Yogyakarta, thousands of rice farmers left their fields in Central Java to fight the Dutch. Local guerilla fighters had the upper hand for the first two years of the confrontation, but the uprising was eventually suppressed by tricking Diponegoro into a treacherous ceasefire, at which point Dutch authorities shamelessly arrested him. An estimated 200,000 combatants were dead by the end of the conflict, including more than eight thousand Dutch soldiers and tens of thousands of Javanese civilians. If the colony was to be maintained as a site of Dutch prosperity, a new approach to its governance would be necessary.

Created in the aftermath of the Java War, Junghuhn's map dramatically diminished the island's insularity. Scott asserts that, "Historically, the relative illegibility to outsiders of some urban neighborhoods (or of their rural analogues, such as hills, marshes, and forests) had provided a vital margin of political safety from control by outside elites."³² In this context,

31 Aust, "Junghuhn als Landvermesser und Kartograph," 100.

32 Scott, *Seeing Like a State*, 54.

Junghuhn's island map provided both evidence of the colonized territory and an instrument for its further domination. It follows that, at the very moment Java becomes cartographically addressable, its insularity diminishes within an ever-increasing imperial force field. Sternagel describes how, with the end of the Java War, Dutch rule was re-stabilized and the island population was coerced into a system of highly taxed agricultural labor, which lasted the ensuing 100 years, until the beginning of the twentieth-century Independence movement.³³

Junghuhn anxiously awaited news about how his masterpiece was received by those who commissioned it; he, like so many other European scientists, aimed to please the masters who ruled at a distance with the delivery of impressive scientific findings. No less unexceptionally, Junghuhn also appears to have wandered from his original mission, to the point of escaping the truth of its purpose altogether. The commission of the *Javakaart* allowed Junghuhn to retreat from the confines of colonial service; instead, he was free to traverse Java's majestic mountain peaks. Yet, he could not have failed to recognize the value of the map for the future military occupation of the island, even if it seems that he struggled to admit the gravity of his own role in environmental and cultural destruction caused by the colonial project. In some instances, he preferred to indict "the 'indifference of the Javanese' along with the increase in local population and the rising demand for rice fields and firewood"³⁴ as the main cause of deforestation. On rarer occasions, however, one does find in his writing explicit criticism of colonialist expansion:

33 Renate Sternagel, *Der Humboldt von Java: Leben und Werk des Naturforschers Franz Wilhelm Junghuhn, 1809–1864* (Halle: Mitteldeutscher Verlag, 2011), 80.

34 Sternagel, *Forschen, Vermessen, Streiten* (2009), 26.

Through increasing population, and cultivation of the soil the beauty of nature is destroyed. The magnificent flowering bushes, the grasslands alternating with forests and home to so many living creatures, so attractive, so entertaining to see—they are being crowded out by the land use systems predominant in central Europe, by ugly monotonous fields, which one cannot look at without wishing to get away as quickly as possible. This is the end of the song for which Nature sacrificed herself.³⁵

Still, as he surveyed the island, the pleasure of such a pursuit—the pure act of mapping—seems to have largely obscured the commitment to universal human freedom that sometimes appears in his writings, including several essays in which he explicitly decries the colonial occupation of the island and the violence of the Dutch authorities. While such ethical sentiments indicate a potential, underlying ambiguity, even an uncertainty on his part, they did not prevent Junghuhn from completing his task. Indeed, the map was of such exceptional quality that, following its arrival in Europe, he received a letter of praise from none other than Alexander von Humboldt. In a letter dated 20 April 1857, the renowned naturalist remarked emphatically, "How can I thank you enthusiastically enough for your beautiful, truly geological, richly designed map. Following a military dinner, the King, Prince Friedrich of the Netherlands, the Minister of War, as well as several other generals all long admired it as very excellent

35 Franz Wilhelm Junghuhn, "Afterword," *Java, seine Gestalt, Pflanzendecke und innere Bauart*, Vol. 1 (Leipzig: Arnold, 1857); quoted in *Forschen, Vermessen, Streiten* (2009), 27.

work.”³⁶ For decades to come, Junghuhn’s cartographic synthesis of Java would serve as a tool of colonial domination, guiding explicit military campaigns as well as resource extraction and plantation management. In his wide-ranging study of “immersive” colonial psychologies, philosopher Peter Sloterdijk summarizes the ethical paradox succinctly: “Whoever draws the map behaves as if he were culturally, historically, legally and politically in the right.”³⁷ Although Junghuhn simply could not have doubted the role his map would play in the project of colonial conquest and its attendant deforestation, his reverse hallucinations among the high peaks of Java allowed him to deny (at least, to himself) the inevitable outcome of his scientific study; of course, the map of the island is not an island.

The Climate of Deforestation

The advantage of thinking through plantations is that the patchy Anthropocene is immediately apparent.

— Anna Tsing, “Earth Stalked by Man,” 2016

In addition to subsequent cartographic surveys and a variety of measurements recorded at the request of other German scientists, Junghuhn’s research unfolded according to several

- 36 Max C. P. Schmidt, *Franz Junghuhn: Biographische Beiträge zur hundersten Wiederkehr Seines Geburtstages* (Leipzig: Verlag der Duerr’schen Buchhandlung, 1909), 340–41. The letter is quoted in Sternagel, “Franz Junghuhns Forschungen auf Java 1836–1848,” *Forschen, Vermessen, Streiten* (2010), 65.
- 37 Peter Sloterdijk, *In the World Interior of Capital*, trans. Wieland Hoban (Cambridge: Polity Press, 2005), 103.

additional governmental mandates he had received from the Dutch, both of which concerned trees. In 1856, he was asked to oversee the development of cinchona plantations, a South American tree species, which Alexander von Humboldt and Aimé Bonpland had first described for Western medical science in the course of their expedition fifty years earlier (1799–1804). The curative power of cinchona bark was understood by Amerindian peoples for centuries, but the cultivation of cinchona trees became a key resource for colonial expansion because the bark’s quinine provided a much-needed treatment for malaria.³⁸ The second official assignment involved an investigation of the “degree, state, and extent” of deforestation on Java by comparing the state of the island to previously conducted surveys. This latter task is noteworthy as it led Junghuhn to study and then speculate on the relationship between deforestation, rainfall, and the water depth of creeks and rivers, ultimately leading to his hypothesis that climate change would be an inevitable consequence of deforestation.

Some of his more prescient observations are relayed in another letter to von Humboldt, dated 8 December 1856, in which Junghuhn describes woodlands that “have been notably cleared, even here in the well-wooded western highlands of the island.” The formerly overflowing riverbeds were now “found to be almost dry, leading to the non-irrigation of a large part of the *Sawahs*.”³⁹ Junghuhn then explains his understanding of

- 38 On the controversies around Junghuhn’s approach to cinchona cultivation, see Andrew Goss, *Floracrats: State-Sponsored Science and the Failure of the Enlightenment in Indonesia* (Madison: University of Wisconsin Press, 2011), 33–46.
- 39 “Fr. Junghuhn’s neueste Untersuchungen in Java, Aus einem Schreiben Fr. Junghuhn’s an Herrn A. v. Humboldt,” *Zeitschrift für allgemeine Erdkunde* (1857), 506–517: 510; http://www.digizeitschriften.de/dms/img/?PPN=PPN391365622_1857_0002&DMID=dmdlog85. We sincerely thank Renate Sternagel for pointing us to this letter.

the relationship between forests, fluvial water levels, and the intensity of the winds, particularly the “West Monsoon” from the Indian Ocean and what he calls the “good and dry Monsoon” coming from Australia. Much in resonance the systemic correlations between deforestation and human-induced climate change Humboldt himself deduced from his observations in South America, Junghuhn’s hypothesis is that deforestation will not only cause additional droughts, but greater differences among the various types of wind, thereby transforming the regional climate. Anticipating the emergence of extreme weather conditions produced through deforestation, Junghuhn then speculates:

I believe that it won’t be easy to prove a decrease of rainfall during the West Monsoon [...] as being caused by the deforestation of certain areas; as well as proving that the droughts during the so-called good and dry Monsoon [...] will become intensified as a consequence of the deforestation of some areas, which will first lead to stronger contrasts between the monsoon weather conditions as well as produce extremes; one example being the good monsoon of 1855 where, in Batavia and many other areas on Java, not one raindrop fell for seven months.⁴⁰

While Junghuhn goes on to note that this claim requires a more “fully and carefully” conducted investigation of the entire island of Java, in his conclusion he nevertheless argues that new trees must be methodically planted to avoid this regional climate

40 Ibid., 510.

change; to insist on his point, he also provides a list of eligible species.⁴¹ Junghuhn’s early admonishments regarding colonial land-use transformation can still be heard—if only as an echo that continues to be ignored—in contemporary reports about drought-stricken rice fields, drinking water shortages, landslides, and severe flooding occurring as a result of deforestation and attendant terrestrial transformations, especially the expansive new oil palm plantations in Borneo, Sumatra, and West Papua.⁴² Without forests, the heavy rainfalls of the monsoon season can no longer be absorbed into the ground; this excess water regularly inundates villages and cities, while also expediting the loss of topsoil that is washed away into the sea.

Given Junghuhn’s role in the cartographic subjugation of Java, it might strike the contemporary reader as especially contradictory when he articulates deep frustrations over colonial projects that necessitate further deforestation. Importantly, his conception of the forest, and of nature itself, remains grounded in a Romantic vision that is at once sublime and spiritual: “The first impression mandated silence, similar to the kind one inevitably loses oneself in upon suddenly entering, from a brightly sun-lit street, into the sanctuary of a highly vaulted, gothic church.”⁴³ At times, Junghuhn’s reveries come remarkably close to those of his fellow German, Friedrich Nietzsche, whose

41 Ibid., 510–11.

42 A 2013 report by Greenpeace International identifies crude palm oil production as the single largest driver of deforestation in Indonesia. See *Certifying Destruction: Why Consumer Companies Need to Go beyond the RSPO to Stop Forest Destruction* (Amsterdam: Greenpeace, September 2013), <http://www.greenpeace.org/international/Global/international/publications/forests/2013/Indonesia/RSPO-Certifying-Destruction.pdf>.

43 Junghuhn, “Der Zustand der angepflanzten Chinabäume auf Java,” in *Bonplandia: Zeitschrift für die gesammte Botanik* 188 (1858), 77; see also Sternagel, “Der Beitrag Junghuhns zur Cinchona-Kultur auf Java,” *Forschen, Vermessen, Streiten* (2010), 135–57, esp. 146–47.

obsession with mountain peaks as an image for free thought would culminate, forty years later, with Zarathustra dancing in the clear air of these heights, far from the masses who could not undergo his call for a “transvaluation of values.”⁴⁴ Similarly, Junghuhn writes:

How satisfied, how light in spirit can one rest in these heights, while the wind sighs softly through the Casuarina pines and the stars twinkle through the light green vault of the shelter. No heavy roof of tiles hides from us the friendly view of the heavens, no heavy ceiling presses down on us from above, no gloomy walls confine us, one breathes freely and lightly above the heavy atmosphere of the lowlands, where—in dark caves they call houses—live people suspicious, small-minded, and confined.⁴⁵

In fact, Junghuhn’s tropical “paradise” exists exclusively among the high altitudes of Java, far away from the “suspicious, small-minded, and confined” aspects of colonial society that his cartography helped to develop. It is evident that the geographical distance separating the free, high mountains from the colonial enterprise on the plains below was, at the same time, a psychological schism that allowed Junghuhn to parse his conflicting, *schizoscopic* view of colonization.

The fragility of this geo-psychological division is exemplified by an episode that took place in 1839. In the spring of that year, Junghuhn explored the area around the Gunung Gedeh;

44 Friedrich Nietzsche, *Also sprach Zarathustra: Ein Buch für Alle und Keinen* (Cologne: Anaconda Verlag, 2005).

45 Junghuhn on Gunung Kawi in 1844, quoted in *Forschen, Vermessen, Streiten* (2009), 30.

at the peak, he discovered what he describes as a peaceful and fertile meadow with a freshwater creek, mushrooms, small flowers, and numerous traces of the wild rhinoceros of West Java. He was also delighted to encounter a primula which he had discovered a few weeks earlier—later named *Primula imperialis* Jungh.—when he climbed Mount Pangrango, a 3,000-meter-tall extinct volcano also located along the Sunda Arc. Reflecting on these experiences, Junghuhn compares the picturesque summit to a “castle built into the clouds.”⁴⁶

Towards the end of the year, he again ascended Gedeh to the summit, but the area had changed drastically. No longer a secluded haven, the area was now, so he notes, overrun by undernourished Javanese workers building colonial infrastructure. Shocked by this encounter, he begins to realize that it was his own report about the fertile land that led to its destruction. Full of nostalgia for the lost paradise (if not guilt), he remarks: “Wistfully I left this beautiful summit; wistful for seeing how many of its solitary blossoms had already been crushed, and how many a small, beautiful tree had to fall to the axe, since the short time that I had first made this place known in Buitenzorg.—A significant expanse of its lovely forest [...] had already been hopelessly mowed down.”⁴⁷ While deforestation in Indonesia’s rain and peat forests continues unabated to this day, we are compelled to reflect on these statements from an earlier colonial period because they reveal a more general

46 Junghuhn, *Topographische und naturwissenschaftliche Reisen durch Java* (Magdeburg: E. Baensch Verlag, 1845), 447.

47 *Ibid.*, 495. Three years later, in 1842, he returned again only to discover further destruction: “Instead of forests, which one could have called virgin, strawberries and cauliflower had been planted, even European fruit trees could be spotted.” Junghuhn, *Java, seine Gestalt, Pflanzendecke und innere Bauart*, Vol. 2 (Leipzig: Arnold, 1857), 18.

↘ Fig. 03. European scientists holding a white sheet to provide contrast while photographing a coffee plant, Buitenzorg Botanical Garden, Bogor, Java, circa 1900. Image from the exhibition *125,660 Specimens of Natural History*, Komunitas Salihara Gallery, Jakarta, 2015. Courtesy of the Indonesian Institute of Science.



pattern that characterizes the will to knowledge. Despite occasional lamentations, and even while predicting severe consequences such as climate change, it is evident that Junghuhn suppressed his ethical uncertainties in order to execute his colonial duties in the name of science. But was this science in name only?⁴⁸ Would Junghuhn's practice have differed if his research was articulated in a non-positivist scientific context? This is an extremely difficult question, tending as it does toward a severe anachronism; fundamentally, we cannot answer it directly. Yet, what we want to stress is that Junghuhn's doubt, his recurring uncertainty about the colonial project, and his intuitive concerns about climate change, were all subsumed under an image of positivist technoscience that connected a colonial political economy, field observation, and scientific measurement in an inescapable loop of socio-environmental violence. Even while reveling in the freedom he was afforded by the many high summits of the Javanese mountains, he ultimately refused to see how his observations would condemn the human and nonhuman inhabitants living below to brutal forms of colonization. But, even if it is obvious that his tropical paradise could not be sustained through the colonial observations which almost immediately mandated its eradication, could such a paradise at least be collected?

48 See Isabelle Stengers, *Power and Invention: Situating Science*, trans. Paul Bains (Minneapolis & London: University of Minnesota Press, 1997).

Collecting Paradise

There was no seeing everything at once: no certainty.

— Ursula K. Le Guin, *The Word for World is Forest*, 1972

Between 1854 and 1862, the British naturalist Alfred Russel Wallace explored the Malay Archipelago, ardently documenting the region's geography and biodiversity while amassing a enormous collection of specimens for museums in Europe. His fieldwork, findings, and personal experiences are chronicled in the book *The Malay Archipelago: The land of the orang-utan, and the bird of paradise—A narrative of travel, with sketches of man and nature*, published in 1869 following Wallace's return to Europe. The complex relationship between the will to knowledge and the gathering of scientific data is illustrated in part by the unfathomable scale of Wallace's collection of natural history specimens. As a young man in his early twenties, he had come across the controversial, anonymously published *Vestiges of the Natural History of Creation*, which first ignited his fascination with the heretical idea that organisms might change their form over time; while the notion provoked in Wallace a plan for future research, the suggestion that species' *transmutation* could explain the natural efflorescence was rigorously opposed by Charles Lyell, Britain's preeminent geologist.⁴⁹ Committed to understanding first-hand this complex problem of morphological development, together with his friend and fellow "beetle-hunter" Henry Bates, Wallace planned for a collecting expedition to the Amazon Basin, which would occupy him from 1848 to 1852. The South American tropics were a

49 For a careful discussion of this context, see our interview with Georges Beccaloni in this volume, 68–83.

fecund region for an extensive study of evolution; indeed, as Wallace noted in a pre-departure letter to Bates: “I should like to take some one family to study thoroughly—principally with a view to the theory of the origin of species.”⁵⁰ Yet, even after Wallace filled his notebooks with detailed reports, sketches of plants and animals, and maps—all of which produced a preliminary basis for understanding biogeographical distribution in the Amazon—his groundbreaking scientific revelation would have to be deferred. While he was returning to Europe aboard the *Helen*, after twenty-six days at sea, the brig’s cargo caught fire and the vessel was abandoned; Wallace lost nearly everything he had painstakingly collected and recorded.⁵¹

Two years later—still convinced that he would be able to solve the problems of natural selection, geographical distribution, and variations in plant and animal life only if he could gather an original collection that would be as varied and comprehensive as possible—Wallace would try again to solve the riddle of species transmutation, this time in Southeast Asia. During his eight years in the Malay Archipelago, he sent back to England an amazing 125,660 specimens of natural history, among them five thousand species hitherto unknown to science. While many of these were sold to private collections and museums, Wallace kept for himself approximately three thousand bird-skins (including roughly one thousand different species), as well as twenty thousand beetle and butterfly

specimens.⁵² The sale of these specimens allowed Wallace to pay for his travels and, after his return to Europe, he was able to use his personal collection to continue thinking through various questions of evolutionary biology.⁵³ The following passage from an essay published one year after the expedition, “On the Physical Geography of the Malay Archipelago,” explains Wallace’s rationale for pursuing a “perfect collection”:

[The naturalist] looks upon every species of animal and plant now living as the individual letters which go to make up one of the volumes of our earth’s history; and, as a few lost letters may make a sentence unintelligible, so the extinction of the numerous forms of life which the progress of cultivation inevitably entails will necessarily render obscure this invaluable record of the past. It is therefore an important object, which governments and scientific institutions should immediately take steps to secure, that in all tropical countries colonised by Europeans the most perfect collections possible in every branch of natural history should be made and deposited in national museums, where they may be available for study and interpretation.⁵⁴

50 Alfred Russel Wallace in a letter to Henry Walter Bates, 11 October 1847; WCP348.348 in Wallace Letters Online/Wallace Correspondence Project, http://www.nhm.ac.uk/resources/research-curation/projects/wallace-correspondence/transcripts/pdf/WCP348_L348.pdf.

51 Wallace, *A Narrative of Travels on the Amazon and Rio Negro* (New York, Dover Publications, 1972), 271–79.

52 Preface to Wallace, *The Malay Archipelago*, (Singapore: Periplus, 2008), xxi.

53 On the sale of specimens, see Sandra Knapp, *Alfred Russel Wallace in the Amazon: Footsteps in the Forest* (London: Natural History Museum, 2013), 31–42.

54 Wallace, “On the Physical Geography of the Malay Archipelago,” *Journal of the Royal Geographical Society* 33 (1863): 233–4. On the double orientation towards the past and the future that Wallace describes, see Lorraine Daston, “The Sciences of the Archive,” *Osiris* 27, no. 1 (2012): 156–87.

As a “site” for scientific study, the awesome biodiversity of the archipelago is still evident in more contemporary estimations. According to Gavan Daws and Marty Fujita, “in almost all plant and animal taxa, Indonesia has levels of species diversity and endemism that rank within the highest in the world.” Absolute quantitative measures of the world’s biodiversity remain difficult to achieve, but it has been estimated that Wallace was exposed to “more than ten thousand species of trees, about a tenth of the world’s flowering plant species, about an eighth of all mammal species, nearly a sixth of all reptile and amphibian species, a sixth of all bird species, and about a third of all fish species.”⁵⁵

Until just a few decades ago, one could still encounter many of the lush forest landscapes in Southeast Asia that led to Wallace’s two most important publications. First, in February 1855, he wrote “On the Law which has Regulated the Introduction of New Species,” which he published in *The Annals and Magazine of Natural History* in September of the same year. The conclusions of what came to be known as “The Sarawak Law” are a key in the development of a theory of evolution by natural selection: “Every species has come into existence coincident both in space and time with a closely allied species.”⁵⁶ The second publication, which had a more complicated reception, also indicates the significance of Indonesian biodiversity in the development of the theory of evolution. At

the beginning of 1858, Wallace found himself in the Moluccas (the so-called *Spice Islands*), where he spent time on Halmahera, Gilolo, and Ternate. It was here that he was introduced to the Standardwing bird of paradise that would later be given his name: *Semioptera wallacei*. In early March, Wallace sent Darwin a letter asking him to pass his writing on to Charles Lyell “if he [Darwin] thought it sufficiently important to show it to Sir Lyell.”⁵⁷ In the essay which accompanied the letter, “On The Tendency of Varieties to Depart Indefinitely from the Original Type,” Wallace described the mechanism of evolution as the process of “natural selection.”⁵⁸ According to his biographical reflections, this understanding occurred to him as he lay suffering from a severe fever.⁵⁹ On 1 July 1858, the so-called “Darwin-Wallace” paper was read at the Linnean Society in London. The paper was officially published by the Society on 20 August 1858; Darwin’s monograph *On the Origin of Species* followed on 24 November 1859. Many prominent authors have developed careful and considered reflections on Wallace’s contribution to the theory of evolution by natural selection; our ambition is to advance a reading of the will to knowledge as it is instantiated in Wallace’s estimation of the natural world (and the consequences of its degradation) through the development practices at the core of the colonial project.⁶⁰

55 Gavan Daws and Marty Fujita, *Archipelago: The Islands of Indonesia – From the Nineteenth-Century Discoveries of Alfred Russel Wallace to the Fate of the Forests and Reefs in the Twenty-First Century* (Berkeley & Los Angeles: University of California Press, 1999), 185. For a summary on the emergence of the concept of “biodiversity,” see Jessica Dempsey, *Enterprising Nature: Economics, Markets, and Finance in Global Biodiversity Politics* (Hoboken: Wiley-Blackwell, 2016), 35–52.

56 Wallace, “On the Law Which Has Regulated the Introduction of New Species,” in *The Annals and Magazine of Natural History Including Zoology, Botany, and Geology*, Vol. 16, 1855, 184–96.

57 Wallace, *My Life: A Record of Events and Opinions*, Vol. 1 (London: Chapman & Hall, 1905), 363, http://wallace-online.org/converted/pdf/1905_MyLife_S729.2.pdf.

58 See Beccaloni, “Wallace’s Annotated Copy of the Darwin-Wallace Paper on Natural Selection,” *Natural Selection and Beyond*, eds. Charles H. Smith and George Beccaloni (Oxford: Oxford University Press, 2008), 91–101; access a transcript of the “Darwin-Wallace” paper here: <http://wallacefund.info/content/1858-darwin-wallace-paper>.

59 Wallace, *My Life*, 360–63.

60 On development and its colonial origins, see Gilbert Rist, *The History of Development: From Western Origins to Global Faith*, trans. Patrick Camiller (London and New York: Zed Books, 2014).

As a result of logging, forest fires, agricultural clearing, open-pit mining, road construction, and oil palm plantations, many of the areas which afforded Wallace the living evidentiary of evolution have all but disappeared. In fact, it is now estimated that within a decade, ninety-eight percent of the Indonesian rainforest will be destroyed completely if developments remain on a business-as-usual trajectory.⁶¹ When we asked evolutionary biologists whether or not they believed it would still be possible to develop the theory of evolution, or biogeographical distribution, based on a collection of specimens from the Malay Archipelago today, most answered in the negative. According to our interlocutors, animal and plant species have been radically displaced, and many are now present on islands where they would not have been found in Wallace's time. Thus, as a result of various anthropogenic factors, the species' scrambled and often precarious appearance in the devastated forests of the archipelago means that the story they tell today is of a very different "nature."⁶²

Still, Wallace was not immune to the realities of land-use transformation in the region, even if these changes were much less destructive in his time than they are among contemporary plantation developments. In one appraisal, Wallace remarked:

- 61 Christian Nellemann et al., *The Last Stand of the Orangutan. State of Emergency: Illegal Logging, Fire and Palm Oil in Indonesia's National Parks* (Arendal: United Nations Environment Programme, 2007), 36, 43, http://gridarendal-website.s3.amazonaws.com/production/documents/s_document/240/original/orangutan-full.pdf?1487684008. Meanwhile, according to the Orangutan Conservancy, nearly eighty percent of possible orangutan habitat has been destroyed over the last twenty years: <http://www.orangutan.com/threats-to-orangutans>.
- 62 Matthias Glaubrecht, *Am Ende des Archipels: Alfred Russel Wallace* (Berlin: Galiani Verlag, 2013), 400–1; see also Glaubrecht in this volume, 185–202.

[F]uture ages will certainly look back upon us as a people so immersed in the pursuit of wealth as to be blind to higher considerations. They will charge us with having culpably allowed the destruction of some of those records of Creation which we had it in our power to preserve; and while professing to regard every living thing as the direct handiwork and best evidence of a Creator, yet, with a strange inconsistency, seeing many of them perish irrecoverably from the face of the earth, uncared for and unknown.⁶³

For Wallace, the blindness of the colonial project and its inevitable destruction of nature makes the entire scientific enterprise culpable because "*we* had it in our power to preserve" [authors' emphasis] these so-called "records of Creation." Such an ecclesiastical image of nature may seem odd, especially given that Wallace's own writing helped to displace the belief that nature was the work of a divine creator. However, as anthropologist Anna Tsing has suggested in her book *Friction*, this idyllic image may still be of strategic importance: "The romance of nature gives grandeur and autonomy to the natural world; those who appreciate that grandeur are also able to feel the shock of nature's desecration and destruction. Is it possible, I wondered, that, even in Indonesia, the romance of nature is one important route to an appreciation of nature's fragility?"⁶⁴ What, then, of Wallace's ambition for a *perfect collection*, which seems to express simultaneously a deep

- 63 Wallace, "Natural History and Conservation," *Infinite Tropics*, ed. Andrew Barry (Verson: New York and London, 2002), 147.
- 64 Anna Lowenhaupt Tsing, *Friction: An Ethnography of Global Connection* (Princeton: Princeton University Press, 2004), 123.

appreciation of nature and a resignation that, through the very act of collecting, the scientist participates in a process that will end in destruction?

Nowhere is this vexing, *schizoscopic* perspective on colonial collecting more pronounced than in Wallace's description of the birds of paradise.⁶⁵ While these remarkable birds were known in Europe at least since the Renaissance, they had arrived there in the form of lifeless skins; curiously, because these skins showed no osteological evidence of their hindlimbs, legend had it that they lived in the sky and never landed on earth except to die. Thus, Wallace was proud to proclaim himself the first Englishman to ever see birds of paradise alive in their terrestrial habitat. He even succeeded, against all odds, in transporting two living birds to London, where he hoped the domestic aviaries of the Crystal Palace or Kew Gardens would allow them to survive in captivity. Paradoxically, it is the experience of beholding their natural beauty in the wild that inspired Wallace to deliver one of his most confounding statements on extinction, which he narrates near the end of *The Malay Archipelago*:

I thought of the long ages of the past, during which the successive generations of this little creature had run their course—year by year being born, and living and dying amid these dark and gloomy woods with no intelligent eye to gaze upon their loveliness; to all appearance such a wanton waste of beauty. Such ideas excite a feeling of melancholy. It seems sad that on the one hand such exquisite creatures should live out their

65 Much more recently, Cornell Lab ornithologist Ed Scholes and wildlife photographer Tim Laman went in Wallace's footsteps to record all thirty-nine bird-of-paradise species on camera as well as audio: <http://www.birdsofparadiseproject.org>.

lives and exhibit their charms only in these wild, inhospitable regions, doomed for ages yet to come to hopeless barbarism; while on the other hand, should civilized man ever reach these distant lands, and bring moral, intellectual and physical light into the recesses of these virgin forests, we may be sure that he will so disturb the nicely-balanced relations of organic and inorganic nature as to cause the disappearance, and finally the extinction, of these very beings whose wonderful structure and beauty he alone is fitted to appreciate and enjoy.⁶⁶

What to make of such a troubling, hallucinatory adumbration today? Is this not the very melancholy that natural history collections and their attendant museum presentations are meant to neutralize?

Traditionally referred to as *manuk dewata* ("God's birds"), it is their second Malay appellation, *burung mati* ("dead birds"), which expresses the cruel irony of their fate as symbols of an expulsion from paradise. There is now no doubt that human activities, including the fanatical consumption of fossil fuels, industrialized agriculture, bioengineering, resource extraction, global waste management, and pollution have violently disturbed Wallace's "nicely-balanced relations of organic and inorganic nature." Direct forms of consumption also played their part in this irreversible *bioturbation*; only a few decades after Wallace left Southeast Asia, the trade in exotic avifauna saw export numbers reach annual highs of up to 80,000 bird of paradise skins, most of which arrived in Europe to adorn

66 Wallace, *The Malay Archipelago*, 338–9.

luxury items such as women's hats. Such activities caused a far-reaching conflict among residents and colonial authorities that lasted for nearly forty years and resulted in a 1931 prohibition against killing the birds; the debates over the preservation of habitats for birds of paradise are thus said to mark the start of environmental politics in Indonesia.⁶⁷

Wallace's narrative in the Anthropocene, as with Junghuhn's, trouble any simple inheritance of the colonial will to knowledge. If the acquisition of knowledge by way of colonial collecting was, according to Wallace, indelibly connected to an inevitable process of extinction, how might we reconcile such scientific ambitions with the demand for an ethical disposition that could contest such violent eventualities? On this point, we concur with the philosopher of science Michel Serres when he writes, "We are embarked on an irreversible economic, scientific, and technological adventure; one can regret the fact, and even do so with skill and profundity, but that's how it is, and it depends less on us than on *what we have inherited from our history*."⁶⁸

67 On the detailed history of bird-of-paradise conservation as discussed in Robert Cribb, "Birds of Paradise and Environmental Politics in Colonial Indonesia, 1890–1931," *Paper Landscapes: Explorations in the Environmental History of Indonesia* (Leiden: KITLV Press 1997), 379–408. In his conclusion, Cribb discusses "the elevation of the birds of paradise to become conservationist symbols," 404.

68 Michel Serres, *The Natural Contract*, trans. Elizabeth MacArthur and William Paulson (Ann Arbor: University of Michigan Press, 1995), 5; our emphasis.

Inheritance & Intrusion

The instant of nature
forming between them drained every drop from the walls of his life
leaving behind just ghosts
rustling like an old map.

— Anne Carson, *Autobiography of Red*, 1998

As Brazilian architect Paulo Tavares has presciently observed, "different regimes of power will produce different natures, for nature is not natural; it is the product of cultivation, and more frequently, of conflict."⁶⁹ So it was at the close of the nineteenth century when another German naturalist, Ernst Haeckel, arrived in Southeast Asia; his personal impressions of the expedition are documented in *Aus Insulinde: Malayische Reisebriefe* (1901) and the three-volume *Wanderbilder* (1904), all of which contain descriptive texts, photographs, and numerous watercolors. The main objective of Haeckel's trip was to continue his research into various *radiolaria*, *medusae*, and *siphonophorae*, not to seek out the so-called "Java Man," the discovery of which he had predicted in the 1860s, following the publication of Darwin's *Origin*.⁷⁰ In his varied reflections on Java, Haeckel does indeed defend the idea of man and ape descending from

69 Paulo Tavares, "The Geological Imperative: On the Political Economy of the Amazonia's Deep History," *Architecture in the Anthropocene*, ed. Etienne Turpin (Ann Arbor: Open Humanities Press, 2013), 236. On the "production of nature" through cultivation—especially through Indigenous modes of forest inhabitation—see also Tavares's essay "The Political Nature of the Forest: A Botanical Archaeology of Genocide," in the fourth volume of *intercalations: The Word for World is Still Forest*, ed. Anna-Sophie Springer and Etienne Turpin (Berlin: K. Verlag & Haus der Kulturen der Welt, 2017), 125–57.

70 The discovery of the "Java Man" (*Homo erectus erectus*) in Indonesia occurred along the banks of the Solo River in Central Java in 1891 by Haeckel's student, the Dutch paleoanthropologist Eugène Dubois. See Rachel Thompson's two-part essay in this volume, 53–67; 121–35.

a shared, extinct primate origin, and maintains that such a theory is already canonical. Although he is not in search of evidence for this “missing link,” he notes that the ability to study the remaining “anthropomorphs” is nevertheless extremely valuable, proceeding to then give an account of a walk he took with a baby orangutan in Singapore’s botanical garden. In this excruciating narrative of colonial racism, he also describes a friendship between the orangutan and a six-year-old Malay boy, which, in his view, could be attributed to the fact that “the lower races” (i.e. Malaysians) share a close evolutionary proximity to great apes. Later, he even suggests that Malays could best be understood as an “amphibian human race” because they enjoy fishing and living on boats.⁷¹

The consequences of such racist ethnographic research are well known after the genocides of the twentieth century; it is our concern to examine the less explicit yet violent inheritance of colonial nature.⁷² For such a review, a final story from Haeckel’s expedition will suffice. In the late fall of 1900, the naturalist visited Buitenzorg’s institute of botany, at the foot of Gunung Gedeh. Following his ascent, it is notable how the fertile plateau was still capable of stirring delight, as it once had done for Junghuhn sixty years before. But Haeckel’s encounter was no longer with wild, tropical nature; instead, the vegetation was supplanted by an image of neatly cultivated colonial plots. Haeckel found no trace of the once abundant rhinoceros, only

71 Ernst Haeckel, *Aus Insulinde: Malayische Reisebriefe*, Chapter 9, “Der Menschenaffe von Java” (Bonn: E. Strauss, 1901), 216–35, esp. 219, 222, 229–31, <http://www.biodiversitylibrary.org/bibliography/36308#/summary>.

72 On this positivist ethnographic history, we were especially moved by the exhibition *Vermessung des Unmenschen: Zur Ästhetik des Rassismus* [Surveying the Non-Human: On the Aesthetics of Racism], curated by Wolfgang Scheppe at the Staatliche Kunstsammlungen Dresden in 2016. See <http://www.skdmuseum.de/sonderausstellungen/archiv/die-vermessung-des-unmenschen/index.html>.

emerald green, terraced rice fields. He noted, “It is especially through the numerous scattered villages (*kampongs* or *dessas*) surrounded by orchards and surmounted by the canopies of palm trees that the friendly impression obtains a highly painterly charm.”⁷³ The area was completely changed, which is to say, *colonized*. The imported fruit saplings from Europe that once traumatized Junghuhn—even if it was his own report that led to their planting—had now successfully taken root, giving the site a harmonious appearance of a cultivated, but no less abundant, tropical nature. How should we read this colonial inheritance? If Haeckel could so casually apprehend the colonization of the landscape as an objective fact of nature, or at least as an indication of the successful management of nature under the Dutch, how might we, in the Anthropocene, begin reassembling the various natures which are now entirely subsumed under a system of a Integrated World Capitalism?⁷⁴

One approach would involve a reconsideration of the act of scientific observation itself. In a startling footnote meant to summarize the consequences of the German forestry industry on tropical nature, historian James Scott makes an exceptional comment about the results of *reverse hallucinations*. Referencing Werner Karl Heisenberg, the theoretical physicist best known for his treatment of the problem of *uncertainty* in scientific observation, Scott notes that the colonial will to knowledge produces a stultifying transformation. “Instead of altering the

73 Haeckel, “Wanderbild II: Der Vulkan Salak bei Buitenzorg,” *Wanderbilder: Die Naturwunder der Tropenwelt Ceylon und Insulinde* (Gera-Untermhaus: W. Koehlersche Verlagsbuchhandlung, 1904), <http://caliban.mpiz-koeln.mpg.de/haeckel/wanderbilder/>; description is based on “Im Garten von Beutenzorg,” *Malayische Reisebriefe*, 54–91, esp. 61, <http://www.biodiversitylibrary.org/bibliography/36308#/summary>.

74 Félix Guattari, *Soft Subversions: Texts and Interviews 1977–1985*, ed. Sylvère Lotringer, trans. Chet Wiener and Emily Wittmann (Los Angeles: Semiotext(e), 2007).

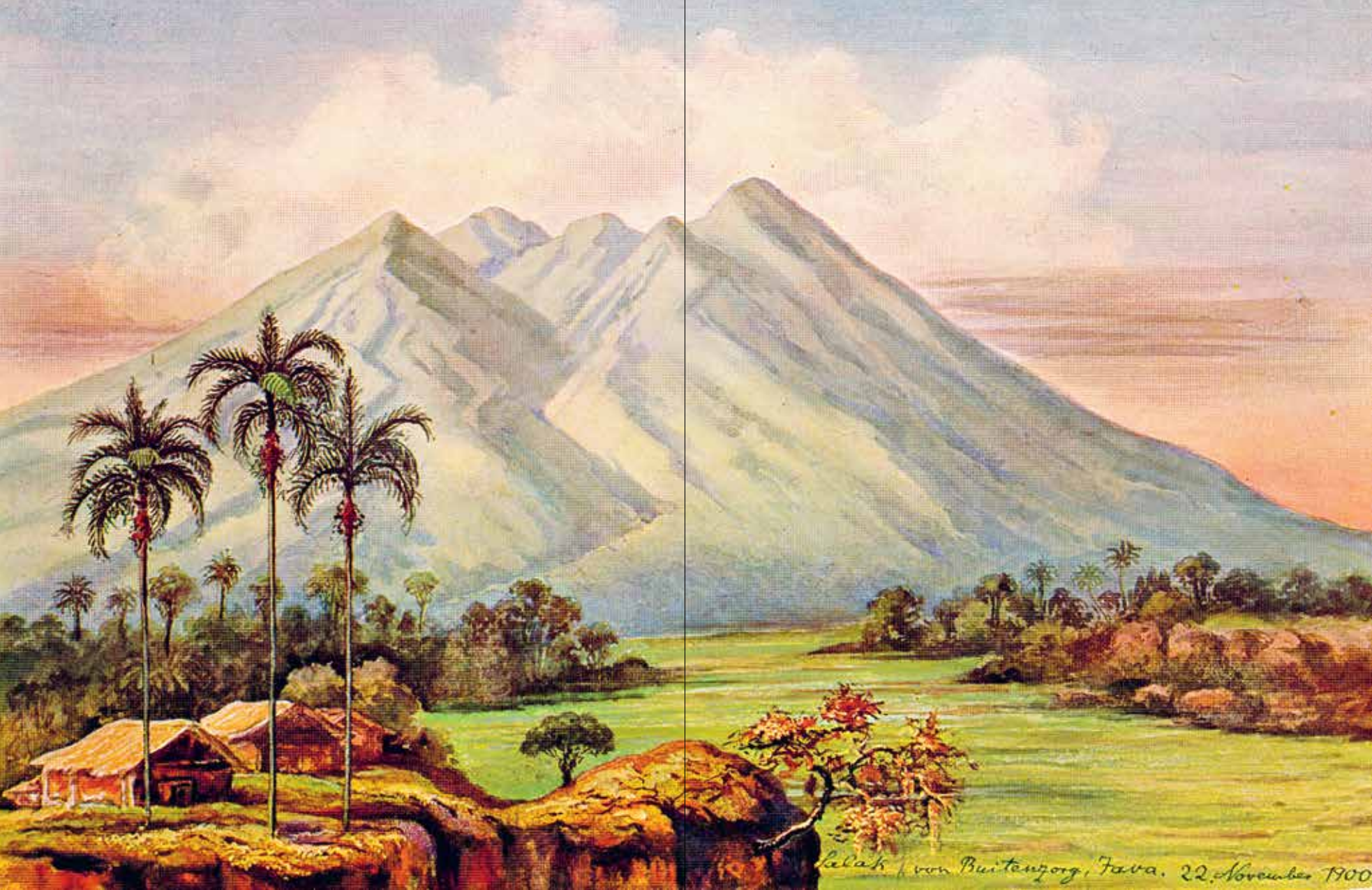


Fig. 04. Watercolor by Ernst Haeckel of Gunung Salak near Buitenzorg, Java. Plate from his book *Wanderbilder: Die Naturwunder der Tropenwelt Ceylon und Insulinde*. Gera-Untermhaus: W. Koehlersche Verlagsbuchhandlung, 1904.

phenomenon observed through the act of observation, so that the pre-observation state of the phenomenon is unknowable in principle,” Scott suggests that, “the effect of (uninterested) observation in this case is to alter the phenomenon in question over time so that it, in fact, more closely resembles the stripped down, abstract image the lens had revealed.”⁷⁵ From this perspective, Haeckel’s view is a *post-observational* summary of colonization; that is, as the latest observer, he sees only the results of what his predecessors produced through their *reverse hallucinations*, culminating in *an image of the colony as nature itself*.

A second approach to reassembling the natural, which we would like to propose here, returns us to the claim with which we began—namely, that the enduring image of science as an enterprise committed to a positivist clarification of knowledge through the elimination of any ethical friction or moral doubt, subverts contemporary inquiries into climate change and related forms of environmental violence. How exactly does the history of the colonial will to knowledge in the tropics evince such a concern? As Lorraine Daston and Peter Galison have noted, “Their cultivated individualism and voluntarism may seem diametrically opposed to self-effacing objectivity, but, in fact, subjectivity and objectivity defined poles of the same axis of the will: the will asserted (subjectivity) and the will restrained (objectivity)—the latter by a further assertion of will.”⁷⁶ The suppression of ethical concerns by way of the subjectivation processes required by positivist colonial scientific practices form the historical preface to the Anthropocene. How to best describe this suppression and its irruptive albeit minor history of uncertainty?

75 Scott, *Seeing Like a State*, 359–60, fn. 6.

76 Lorraine Daston and Peter Galison, *Objectivity* (Cambridge: The MIT Press, 2007), 228.

The inimitable philosopher of science Isabelle Stengers has recently reoriented the discussion of the Anthropocene with her claim that what is now being witnessed—whether under the flag of the Anthropocene, climate change, or the generalized anthropogenic disturbance of the world and its many worlds—might be best described as the *intrusion of Gaia*.⁷⁷ As Stengers writes, “Gaia is neither Earth ‘in the concrete’ and nor is it she who is named and invoked when it is a matter of affirming and of making our connection to this earth felt, of provoking a sense of belonging where separation has been predominant, and of drawing resources for living, struggling, feeling, and thinking from this belonging. It is a matter here of thinking *intrusion, not belonging*.”⁷⁸ She continues, “The intrusion of this type of transcendence, which I am calling Gaia, makes a major unknown, *which is here to stay*, exist at the heart of our lives. This is perhaps what is most difficult to conceptualize: no future can be foreseen in which she will give us back the liberty of ignoring her. [...] We will have to go on answering for what we are undertaking in the face of an implacable being who is deaf to our justifications.”⁷⁹ Within this study of reverse hallucinations, the intrusion of Gaia requires one additional clarification.

Stenger’s intrusion “at the heart of our lives” cannot, we are sure, come solely from the outside; indeed, if there anything is

77 For an especially exciting reading of the intrusion of Gaia and the worlding of worlds, see Déborah Danowski and Eduardo Viveiros de Castro, *The Ends of the World*, trans. Rodrigo Nunes (Cambridge: Polity Press, 2017).

78 Stengers, *In Catastrophic Times: Resisting the Coming Barbarism*, trans. Andrew Goffey (London: Open Humanities Press, 2015), 43–4. See also “Matters of Cosmopolitics: On the Provocations of Gaia,” Isabelle Stengers in conversation with Heather Davis and Etienne Turpin, *Architecture in the Anthropocene: Encounters Among Design, Deep Time, Science and Philosophy*, ed. Etienne Turpin (Ann Arbor: Open Humanities Press, 2013), 171–82.

79 Stengers, *In Catastrophic Times*, 47.



Fig. 05. Truckloads of oil palm fruits being delivered to a crude palm oil mill in the Bengkulu area, Sumatra, Indonesia. Photo by the authors, 2014.

to be taken away from this essay, it is that *we*, all of us—scientists, critics, and curators alike—are *of* Gaia and thus carry her “inside” of us as much as she (much more evidently) carries us. From this perspective, Gaia is at least as much an erratic, disruptive neuroecological force as she is an environmental, planetary-scaled macrophenomenon beyond our apprehension.⁸⁰ To think the *irrepressible* force of ethics among entities—in spite of and against the positivist technoscientific assemblage that helped fashion our colonial naturalist predecessors—we do not require an idealized moral universality, nor any subject-centric consciousness-raising. Instead, to think the intrusion of Gaia upon the “heart of our lives,” through each and every act of inquiry, would mean to rediscover, in this soiled and often repulsive legacy of the will to knowledge, a line of flight that is both *of* and *for* Gaia.⁸¹ Emboldened by this minor history, why would we continue to assign to a science worthy of the name a repressive function in relation to such constituent intrusions? As Déborah Danowski and Eduardo Viveiros de Castro have contended in their own reading of Stengers’ Gaia provocation, “the relation between humanity and the world can begin to be thought as the relation connecting the one side of a Möbius strip to itself: as a non-orientable figure in which the inseparability of thought and being, animate and inanimate, culture and nature is [...] a complete and real substantiality or oneness, precisely like the surface of the

80 Sanford Kwinter, “Neuroecology: Notes Toward a Synthesis,” *The Psychopathologies of Cognitive Capitalism. Part Two*, ed. Warren Neidich (Berlin: Archive Books, 2013), 313–33. A special thanks to Nashin Mahtani for bringing these connections to our attention.

81 Such a line is in keeping with what Kwinter calls “the dynamic sympathetic mutuality with reality,” *ibid.*, 328.

Möbius strip.”⁸² Emphatically, for Danowski and Viveiros de Castro, this is possible because, “Humanity and the world are *literally* on the same side; the distinction between the two terms is arbitrary and impalpable: if one starts from humanity (thought, culture, language, the “inside”) one necessarily arrives at the world (being, matter, nature, the “Great Outdoors”) *without crossing any border* and conversely.”⁸³ In the kaleidoscopic profusion of nature that characterizes the tropics, invasive moments of uncertainty could be mistaken for some fractured European morality, but such a reductive account would fail to articulate a politics of scientific inquiry. Instead, the irruption of Gaia as *neuroecological dissonance* (leading to the proliferation of reverse hallucinations as attempts to neutralize such *psychoturbations*) can be understood as a confrontation—at once psychological and ecological—between thinking-being *in* and *of* nature as such. What is required of non-positivist scientific practice *in* and *for* the Anthropocene is therefore the cultivation of an intimacy with the “section of chaos” under consideration, which is as “internal” to the process of subjectivation as it is disruptive to any long-feigned objectivity.⁸⁴

The American artist Catherine Lord has also explored the effect of tropical light on white men and their attendant justifications for violent, hallucinatory programs in the torrid zone.⁸⁵ Following Lord, there seems to be an equatorial effect that led

82 Danowski and Viveiros de Castro, 113.

83 *Ibid.*

84 Gilles Deleuze and Félix Guattari, *What is Philosophy?*, trans. Hugh Tomlinson and Graham Burchell (New York: Columbia University Press, 1994), 42.

85 In her project, Lord was looking at the “memory books” of Henry Alfred Alford Nicholls, the Principal Medical Officer of British-controlled Dominica at the end of the nineteenth century; see Catherine Lord, “The Effect of Tropical Light on White Men,” in *Scapegoat: Architecture|Landscape|Political Economy* 01, *Service*, ed. Jane Hutton and Etienne Turpin (Summer 2011): 14–15.

European men of science to egregiously double-down on their epistemic efforts among the tropical islands under colonial possession during the eighteenth and nineteenth centuries. We can use the neologism *heliopsychosis* to precisely name this effect, specifically in order to make an essential link between exposure to the tropical solar zenith—with its excessive clarity among the high peaks and shape-shifting edges of its watery archipelago—and the will to knowledge that blinded the colonial naturalists laboring under this potent star as they surveilled a transgressive and puzzling equatorial abundance. While we are certain this colonial disposition cannot (and should not) be reduced to any kind of *meteorological determinism*, the frequency and consistency of *reverse hallucinations* in the tropics is indisputable. Thus, as the planet continues to warm, and as the tropics begin to spread perilously toward the temperate zones of the Earth, this phenomenon might be worth *thinking*—in our sciences as much as ourselves—because our neuroecological disposition to the *new weather* will have considerable bearing on the hospitality we might extend toward such intrusions.⁸⁶ Virginia Woolf was no stranger to this uncanny climatic inflection: “Whatever the sun touched took on a fanatical existence.”⁸⁷ As the accelerating build-up of atmospheric greenhouse gases fervently amplifies sublunar fanaticisms, we might do well by attending more closely to the hallucinatory, positivist paroxysms that accompanied colonialists as they tried to apprehend the vexing multiplicity we call *archipelago*.

86 Kwinter, “Neuroecology: Notes Toward a Synthesis”; for a literary appraisal, see J.G. Ballard, *The Drowned World* (London: Berkely Books, 1962).

87 Virginia Woolf, *To the Lighthouse* (London: Hogarth Press, 1927).

Part 1: Changing Small Bones Into Large

by Rachel Thompson

*Keeping along the path of delusion,
couldn't find a straight line
—so I begin in the middle, three times over.
Tongue is tied yet the fingers have unfurled.
Cognition rendered verbal where digit meets key.*

I.

The source of Java's Bengawan Solo River can be found at Dlepih—home to the daughter of Ratu Kidul, Queen of the South Seas and mystical consort to the sultans of Mataram, last in line of Java's dynastic rulers. The cave from which the source waters flow is known as Tunjungbang—the Red Lotus. Home to the palace of the virgin queen, Tunjungbang alludes to the womb yet is said to resemble an open mouth with tongue pressing against teeth.¹ If you stare at the word *Dlepih* for more than a passing moment, the letters will rearrange themselves to spell *Delphi*—navel of the Earth and home to the Greek Pythia, whose divine prophecies and unintelligible utterings, we are told, were aroused by vapors rising from a

chasm in the rock. While geologists now content themselves in quibbling over the precise chemistry of the oracle's intoxicating fumes—ethylene, methane, or perhaps hydrogen sulfide—my mind cleaves instead to the Delphic notion of a monstrous, magical female body, whose speech might emanate not from the mouth but from the stomach or vulva. We should remember that stomatology treats not diseases of the belly, but rather oral pathologies. But I seem to be getting ahead of myself. Must return to the river.



Dutch anatomist Eugène Dubois was led to the banks of the Bengawan Solo after poking around fruitlessly in Sumatran caves, at one point getting stuck headfirst in a tiger's den. After the fortuitous fossil find of quarrymen in Germany's Neander Valley, it was generally thought that other proto-human

remains would likewise be found in caverns of soluble rock. Yet in regions of active tectonics, bones were also discovered amidst layers of volcanic alluvium, carved away by the movement of running water. In 1833, while venturing north from Buenos Aires along the Rio Paraná, Charles Darwin was astounded by the number of fossilized bones embedded within the grand estuary deposit of the lowland Pampas region. The young Darwin heard from local residents about "the hill of the giant" and "the stream of the animal." He was also told of "the marvellous properties of certain rivers, which had the power of changing small bones into large; or as some maintained, *the bones themselves grew*." In his book *Voyage of the Beagle*, Darwin likens the region to a vast mausoleum of extinct creatures.²

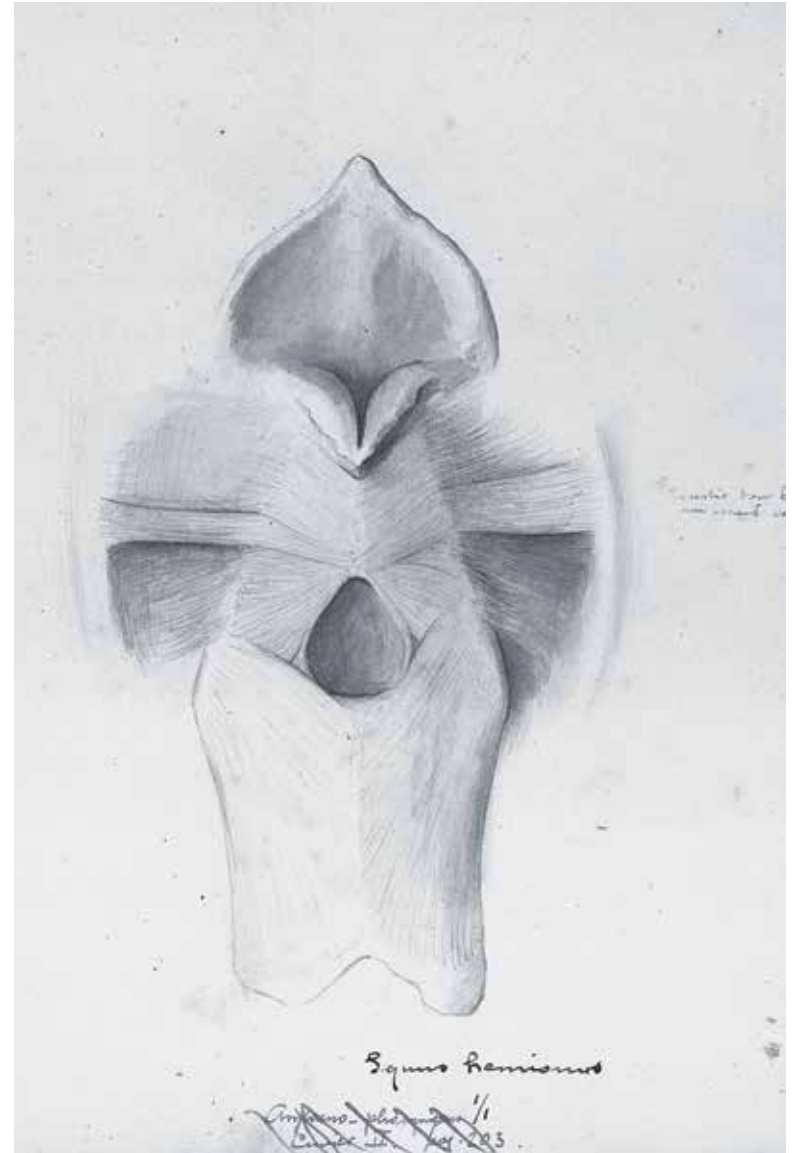
Thoughts of the Beagle were perhaps not far from the mind of Eugène Dubois when, in 1887, against the advice of friends and colleagues, he declined a professorship in Amsterdam and set sail for the Indies, in search of Darwin's missing link. Though Darwin pegged Africa as the cradle of humankind, Charles Lyell and Alfred Russel Wallace allowed for the possibility of Asiatic origins. Denied funding from the colonial government for paleontological pursuits, Dubois sought a military solution, enlisting for an eight-year posting in the Royal Dutch East Indies Army—Medical Officer, Second Class. He detested the work, but at least it would provide passage. He would take up fossil finding on holidays and off-hours—first in caves, later in riverbeds.

At the University of Amsterdam Dubois was known for his flawless dissections and meticulous drawings, and was, on occasion, teased for his golden hands. He read Cuvier, Darwin, Huxley, and Lyell, and was convinced that the Earth had been shaped by slow-moving forces, still in operation in his day.

He gave up on religion by age thirteen, wanting his thinking to be free. He put some stock in the notions of Ernst Haeckel and believed it was now time to establish—scientifically—the groundwork for a non-miraculous history of the human race. Haeckel believed the ape-like origin of *Homo sapiens* was to be found on a submerged continent—not Atlantis but Lemuria, somewhere beneath the depths of the Indian Ocean. Madame Blavatsky, whose views diverged from the evolutionists, described Lemurians as the first physical men, seven feet in height, sexually hermaphroditic, egg-laying, and of the highest spiritual purity. The notion that man had evolved from apes was anathema to her. She wrote that after the creation of mammals, certain depraved Lemurians turned to bestiality, until the gods, aghast, condemned these mindless men. Consumed by a great cataclysm of subterranean fire, their land mass sunk to the bottom of the ocean.³ Haeckel, in his rendering of the tale of human descent, placed great importance on the development of articulate speech and so looked to the larynx as the key to the shift from monkey to man. Following suit, Dubois, for his first manuscript, undertook a comparative study of the larynx in the whale and human. His conclusion: that the mammalian voice box evolved from the gill cartilage of fish.

*From the corporality of utterance to the ambivalence of speech.
No bombast, no chagrin.
A shifting of tongues, an equal exchange.
Is it too much to ask for a wee sliver of slyness?*

Dubois first lobbied for a position in Sumatra, having read of “Boekit Ngalau Seribu”—the hill of a thousand caves. Arriving in the city of Padang on 11 December 1887, Dubois was, from



the start, burdened with the busyness of hospital work, without pause to indulge his excavatory itch. He did, however, carve out time to compose a treatise outlining principles for preferring the Indies as a suitable site for the search for human origins. The following May, by request, he was seconded to a post in the highlands at Paja Kombo, where caring for army convalescents afforded him a more leisurely pace. Excursions began when a fellow physician—himself convalescent—offered to shoulder some of the clinical drudge. The cave of Lida Adjer was a wellspring, offering up remnants of porcupine, pig, gibbon, rhino, tapir, elephant, and deer. Other findspots produced only teeth. Dubois suspected the porcupine as culprit. Bite marks on the few bones to be found bore resemblance to those he produced in an experiment with a live member of the species. A twelve-page unpublished report was drawn up to detail his discoveries, under the name *Voorloopig verslag over palaeontologische nasporingen in grotten bij Pajakombo (Padangsche Bovenlanden)* [Preliminary Report on Palaeontological Investigations in Caves near Pajacombo (Padang Uplands)]. By a government resolution of 6 March 1889, the reluctant physician was released from military service and transferred to the Directorate of Education, Religion, and Industry, where he was accorded a bevy of diggers—fifty forced laborers under the guard of engineering captains Franke and Van den Nesse. In a letter to F.A. Jentink, Director of the Natural History Museum in Leiden, Dubois details his progress: *everything has gone against him; the locals, in fasting, are indolent as frogs in winter; several caves prove false; he can't bear the fatigue of forest living; there are no roads and a near total lack of water; the engineers are useless; one is transferred while the other dies of fever; seven workers have run away and half of those*

remaining have fallen ill; all in all, only a hundredth part of what he had imagined has been achieved. With his third bout of fever, and the near desertion of his search for “diluvialia,” Dubois quits Sumatra and takes leave for Java.

*Later in life, after his towered seclusion,
Michel de Montaigne set out through the spa towns of Europe,
in search of a cure for his debilitating nephrolithiasis.
In the end, it wasn't the stones that did him in,
but rather a case of quinsy and paralysis of the tongue.*

II.

I first went looking for Dubois at the Teylers Museum in Haarlem, with the thought of finding a few items of interest at the institution where he once served as Curator of Geology. I read his annual reports—mere cursory summations. After that, there was little left related to the man. I was most delighted, however, to find gigantic prints of a set of photographs that I had become familiar with back in the States, yet only in miniature. The curator's assistant cleared away my table and placed the album of outsized prints on the floor in its stead. He gave me a short ladder so that I might gain sufficient distance to capture the entirety of each print within the frame of my camera's lens. He then happily spent an hour, splayed on the floor, instructing me in the use of the words “veil” and “unveil” to signal my desire to view a given image without its protective tissue. He told me of his favorites and that his mother was born in Sumatra.

If you say "ok" then I go... Unveil, just say "unveil"... Pisang, payung, obat... No, not in school... Before Australia was discovered with kangaroos, we knew them already... Perhaps now I unveil all the things... You have this one?... After the war, yeah... So you want it like this?... This one's Java... That's where they had a kangaroo jumping!... And you must say "hold on" if you like it... You can see through the veil?... Borneo, no?

I found much more of Dubois at Naturalis, the museum of natural history in Leiden. Before entering its halls, I was distracted by a surfeit of swans within the immediate surrounds. I met one trying to enter a German discount store. Another had gone fishing in the moat girding an office complex. Two camped beside an oversized puddle appeared at first glance to be oddly deformed—one-legged and headless. On approach, however, it seemed they had simply assumed a rather awkward stance for slumber: balanced on one leg with head tucked behind wing.

One enters the museum through the old *Pesthuis*, a former sick-house for those with the bubonic plague. The interior, now gutted, is light and airy—without hint of miasmatic malodour. To reach the vault of Eugène Dubois, one must ascend the adjoining tower and exit at level twelve. Just beyond the door, I beheld row upon row of fossil-lined shelves, with a few larger skulls stashed in the corner. In total: 40,000 bones. Tucked away in a box, down one of the rows, I found specimens that once belonged to Raden Salèh, a self-styled Javanese nobleman and European-trained painter with a penchant for the paleontological. The collection also bore innumerable plaster casts of the brains of various species, Dubois's own teeth, and even a few minor paintings by Salèh, with two of Mount Merapi in a state of eruption. In the office of the curator, I met Yasamin Ibrahim,

a woman from Iraq now studying for her doctorate in Malaysia, digging as Dubois had in Sumatran highland caves. On the curator's desk, I found a student thesis on the dodo of Mauritius, employing a research methodology not unlike Dubois's experiment with the porcupine. The hypothesis that Dutch and Portuguese sailors had eaten the bird into extinction was tested through a comparison of bite marks, using her pet dog and a number of butcher bones as the control.



After leafing my way through Dubois's notebooks filled with delicate depictions of anatomical tissue, I pored over images—digitized on the curator's computer—photographed by Dubois in Java and Holland. He had X-rayed his wife's skull and had an image of his daughter's ringed hand, styled after the first photographic x-ray, Röntgen's *Hand mit Ringen*. He'd photographed friends in the back garden and set up a miniature stage for his ape-man skullcap. In Java, he'd used a man as a measuring stick, documenting stratigraphic layers in relation to the man's stature. There was a tight-lipped taxidermied tiger, a domestic outdoor scene with canine seated in bentwood chair, and what appeared to be the same measuring-stick-man, knee-deep in a jungled stream filled with sizeable stones.

*Way up in Aberdeen, one can hear Professor Ingold
expound upon our bodily bearings in the material world:
What is it, really, that sets man apart from ape? —
the foot, the hand, the brain?
Was it not the feet that brought us here? —their dexterity
now suppressed by the boot?
Shoes and chairs; the paving of streets; strutting about
as if on stilts!
When commanded to walk, they stepped out as if on parade!
Marching head over heels—half in nature, half out—the
human biped figures as a constitutionally divided creature.⁴*

III.

In 1890, having quit Sumatra, Dubois spent a brief spell in Batavia, before settling in a spot along the Bengawan Solo River, near where Raden Salèh and Franz Wilhelm Junghuhn

had both found luck. With his exploits now underwritten by the government, Dubois kept under his employ two envoys of the colonial engineering corps, each with a detachment of penal laborers. From the first expedition, they carted home a large cage, shaped like a minaret. Inside: a five-foot tall marabou stork, the *Leptoptilos crumenifer*. Noted for its towering height and unsightly appearance, the wading bird feeds on carrion and is known to keep company with the vulture. Dubois named his pet The Adjutant, owing to its gait—a parody of a self-important military man. The marabou can grow up to seven feet tall, is capable of digesting large bones, and is known to stand motionless for hours. Some have likened this scavenging creature to the dour mortician, on account of the cloak-like semblance of its wings, its slender white legs, and bald skull stippled with tufts of white hair.



In September 1891, at Trinil along the Bengawan Solo, Dubois's indentured laborers, under the watch of Sergeants G. Kriele and A. de Winter, discovered a molar—the last cheek tooth of an apelike primate. In October, from the same sedimentary layer—one meter below drought line, and twelve to fifteen meters beneath the plane through which the river had cut its course—another piece was unearthed, which the engineers at first take to be the carapace of a turtle. It turned out to be the skullcap of a high-order primate, something with a large brain. The following year, during the dry season, a femur was found. Dubois put the pieces together and calls his creature *Pithecanthropus erectus*—upright-walking ape-man, later to be called Java Man. Excavation then intensified, but all that could be found was the worn-down molar of a baboon. In the same year, Dubois published the book *Climates of the Geological Past and their Relation to the Evolution of the Sun*. There was much debate about Dubois's bones back in Europe. Richard Lydekker considered the fossils fully human and supposed the skullcap belonged to a microcephalic idiot. Others denied an organic connection between the shards, thinking the skull simian, the femur human. Leonce Manouvrier held the most extreme view: that Dubois's creature was a bastard birthed from the sexual union of man and ape.

*We'll raise you up and slide you into the machine.
Oh goodness that's, um, that's very interesting.
This is a human, this is a human throat. That's a
Neanderthal and it's very squat—much higher in pitch.
Add to that a fantastic chest, an immense nasal cavity,
and a very heavy skull pulling down into the throat.*

*I'm now going to engage Elliott by—push into me—
this is actually getting him right into his body.
Now speak.⁵*

Mas Eko took me to the site of Dubois's dig on the back of his motorcycle. His brother Danang carried Pak Santoso, who was much enthused by the extent of a mammoth tusk, on display under glass. He measured its extent against the length of his own wingspan—twice that and a bit, he figured, by the stretch of his discerning arms. After surveying the single water-stained gallery, we wandered down the hill to the riverbank and paused for a while. We met a handful of workers engaged in the removal of sediment—directly across from Dubois's dig—which looked to be rich and volcanic in origin. With bailers of woven bamboo, they scooped up the fecund earth, dumping it into the bed of a sizable yellow truck, in a warp-speed approximation of the river's own erosive power. It was an odd feeling to find myself, now, beside the flow of this storied river whose currents had so long bemused. I ambled up the hill for a view like that upon which I had long fixed my gaze, yet only in photographic reproduction. I was soon stirred from my stupor by a whistle of wind, as it whipped through a thicket of shrubs, one bearing curious leaves of tattered plastic.

The day before, we'd scaled Mount Lawu, site of the ascetic vanishing of the last king of Majapahit and the eastern cosmological anchor of the palace of Surakarta. In courting the spirit world, Soeharto had the whole place fixed up and a new access road built, while readying his own burial site on a nearby slope. We continued on to Sangiran, another fossil site along the Bengawan Solo, discovered in the 1930s, where

an entrance sign proclaimed: Homeland of Java Man. A six-foot-tall ape-like head stood watch over the tour buses moored in the parking lot, its tarmac lined with stalls hawking fossil fragments and morsels of fried food. Visitors were not allowed access to the river, but given free range through extensive exhibition galleries, covering local paleontological finds, the voyage of the Beagle, Mendelian genetics, and the life and death of planetary bodies. The final display was a tableau vivant of a family of *pithecanthropi*, with an appearance at once alarmed and alarming. A young boy, with bruised and battered brow, fixed his cockeyed gaze at the passing onlookers, while partaking of some inner organ. His mother sat in static wonder, clutching an appendage I could not discern—porcine foot or phallus, I suppose. I can't help but think that the grotesque quality of these proto-human models was a bit overdone. As if caught in a spell, frozen in suspended animation, they did put on a great display of utter stillness.

- 1 As described in the *Serat Centhini*, a nineteenth-century Javanese court manuscript.
- 2 Charles Darwin, *Voyage of the Beagle* (London: Penguin, 1839), 131.
- 3 H. P. Blavatsky, *The Secret Doctrine: The Synthesis of Science, Religion, and Philosophy* (New York: William Q. Judge, 1888).
- 4 Tim Ingold, "Culture on the Ground: The World Perceived Through the Feet," *Journal of Material Culture* 9, no. 3 (2004): 315–40.
- 5 *Neanderthal: The Rebirth*, BBC Television (2004).

Fig. 01. (page 54) View of the bend in the Solo River, near Trinil, East Java, where Dubois conducted his excavations. All four figures are courtesy of the Dubois Collection at Naturalis, a research center for biodiversity and museum of natural history in Leiden.

Fig. 02. (page 57) Drawing from one of Dubois's notebooks devoted to the examination of the larynx.

Fig. 03. (page 61) A set of unmarked photographs from Dubois's excavations, which I collectively refer to as "Man as a Measuring Stick."

Fig. 04. (page 63) Sergeants Kriele and de Winter.

Worlds After Wallace

George Beccaloni (GB) in conversation
with Anna-Sophie Springer (AS)
& Etienne Turpin (ET)

Among the experts on Alfred Russel Wallace in the English-speaking world, Dr. George Beccaloni—a former curator of entomology at London’s Natural History Museum, and the Director of the Alfred Russel Wallace Correspondence Project—is perhaps the most compelling advocate for a reassessment of Wallace’s place in the history of science. His knowledge and excitement are contagious, and throughout our various visits, tours, and conversations, we became increasingly certain that our curatorial engagement with the legacy of Wallace was a necessary project to see through, despite numerous obstacles. During our research, we met with George in his office, while tending to the museum’s insect collection, at his home, and in Epping Forest (one of England’s oldest), to discuss the significance of Wallace’s collections and the legacy of his work today. What follows is an edited version of these various conversations, organized thematically (instead of chronologically) for readability. We are grateful to George for his generosity, mentorship, and good humor over the years. He has helped us grasp the nuances of Wallace’s thought, the importance of natural selection, and the amazing world of entomology.

AS

Given your expertise, it would be great if you would start off by providing a bit of context about Alfred Russel Wallace, *The Malay Archipelago*, and insect collecting. I would also be particularly interested in how, at the point when the theory of evolution was formulated, this transformation of knowledge changed the way that museums were ordered.

GB

One of the predecessors of Enlightenment museum collections were the Renaissance cabinets of curiosities, which were just assemblages of interesting and strange objects. After the theory of natural selection was published and people started to accept that species had evolved from other species, displays became much more evolution-based. Wallace, as the co-discoverer of evolution by natural selection, was partly responsible for

this. As the founder of evolutionary biogeography, Wallace was also responsible for another popular type of display, the faunal diorama, where animals of a particular region are shown together in one scene. All the taxidermy mammals of the Andes or the Himalayas, say, are placed together against a natural background showing some of the habitat. This method of display derives from the plates in his important book, *The Geographical Distribution of Animals*. [Fig. 03.]

AS

Let’s step back a bit: who was Wallace and where did he come from?

GB

The basic story is very well known. Wallace was born to a downwardly mobile, middle-class couple in Usk, England (now part of Wales) in 1823. He was educated in Hertford, to the



Fig. 01. George Beccaloni showing some of the beetles Wallace collected in Nusantara to Anna-Sophie Springer in the storage of the London Natural History Museum. Photo by Etienne Turpin.

north of London, and had to leave school when he was only fourteen. Charles Darwin left school much later, when he was sixteen, and then went on to two universities. After leaving school Wallace educated himself from books and also attended working men’s clubs. He became interested in natural history whilst working with his brother as a trainee land surveyor, travelling in the countryside of southern England and Wales. His first interest was botany, as he wanted to identify the plants he saw whilst out surveying. He bought his first books on the subject and realized that there was a whole science behind the classification of plants and animals. He formed a collection of pressed plants in order to remember which species he had seen before and more accurately identify them from the books that he read. He then got a job for a

year as a teacher in Leicester. That’s when he met Henry Walter Bates, a keen beetle collector who got Wallace passionate about insects. Wallace then returned to Wales and started collecting beetles, moths, and butterflies.

ET

Was entomology a fairly common practice at the time?

GB

Yes, there were many entomologists at the time, and they published their records and observations in various specialist journals, just as they do today. However, entomologists formed a tiny proportion of the population, then as now. Most people think you’re weird when you tell them you collect beetles, and probably the same was true back then.

ET

Do you know how long this amateur scientific community of entomologists was working before Wallace's time?

GB

The number of amateurs studying insects increased steadily from the mid-eighteenth century, and as a result the insects and other fauna of Britain were pretty well known by the time Wallace began collecting. By the 1850s natural history had also become very popular among the general public. A friend of mine, the writer and artist Errol Fuller, who is interested in the history of taxidermy, has said that everyone had to have a stuffed bird in their living room at that time. So, there was a greater appreciation of and interest in natural history, and a huge demand for showy foreign specimens to display domestically—butterflies on the wall, or a stuffed bird. However, Wallace's market—the people who did serious scientific work on the collections he sent back from his expedition through the Malay Archipelago (1854–62)—was really just a handful of people. There were probably more amateurs doing the serious work of describing species in Britain than there are now, but that's not the case everywhere. In Eastern Europe, for example, there are still many amateurs doing that sort of work.

AS

Did the majority of specimens that Wallace sent to Europe from the Archipelago end up in private or public collections?

GB

Probably less than fifty percent were purchased directly by the British Museum. Wallace mostly collected insect and bird specimens, and he shipped them to his agent, Samuel Stephens, in London. Stephens

had rooms near the old British Museum (the natural history collections that we have here in South Kensington used to be in Bloomsbury, in what's now the British Museum). When new shipments came in, Stephens would let the scientists in the museum know, and they would come to pick out all the things they thought were interesting or new. The rest of the material was then sold to keen amateurs such as William Wilson Saunders. Saunders would take all of Wallace's smaller orders of insects, whereas the beetles went to certain specialists on the different groups. For instance, Francis P. Pascoe got the longhorn beetles. Stephens often kept some specimens aside for a certain collector. Then there was the general public, who had very little knowledge of natural history but wanted really showy specimens—brightly colored parrots or hummingbirds or whatever—to decorate their homes. We don't know what proportion of specimens went to the third group of people because typically the original labels were removed. Even if you went through collections of old Victorian taxidermy today (and there are many such collections), you wouldn't know if they were Wallace specimens or if they were collected by someone else.

ET

But there was a certain accounting procedure, was there not? Everything had to pass through Stephens, who would have had some form of master list to track payments owed to Wallace, no?

GB

Wallace kept rough records of how many specimens and species he collected on each island and shipped back to Stephens. His notebook detailing his consignments to Stephens

is in the Linnean Society library. Unfortunately, however, Stephens's records do not survive.

AS

Are there any shipping papers or transportation documentations available?

GB

None that were issued by the actual shipping agents, at least none that anybody has ever found. Maybe Stephens had lists but they don't survive at all, so we only have fragmentary information, and we don't even know exactly where most of Wallace's specimens are now. We have a fairly good idea which museums have Wallace specimens in their collections, but we generally don't have lists of the specimens they have. Although I'm pretty sure that there must be thousands of Wallace specimens in the Paris museum, there's no list of them and no way of easily finding them. This is also true in the Natural History Museum, because our specimens haven't been individually databased, and won't be for a very long time, if ever—the collection is just too huge! We have about 25,000,000 insect specimens; although we don't have a record of what Wallace specimens we have, I have estimated that we must have roughly seventy percent of everything he collected. Our museum not only purchased Wallace's specimens directly from Stephens, but many others came in collections formed by entomologists which were purchased, donated, or bequeathed to the Museum when the collectors died. The Oxford Museum of Natural History has the second biggest collection of Wallace's specimens, mostly insects. Sadly, in the whole of the Malay Archipelago there are only two Wallace specimens—a dung beetle in the

Sarawak Museum in Malaysia and a drab little bird in the natural history museum in Singapore.

AS

So what first made you interested in Wallace?

GB

When I was doing my Ph.D. on the evolution of mimicry in butterflies from South America, I became interested in theories of animal coloration—for warnings, camouflage, sexual selection, and so on. I realized that it was Wallace who proposed the majority of these theories. I hadn't really heard of him before, nor did I know that he was the co-discoverer of natural selection, so I started to read a bit more about him. I was reading James Marchant's *Alfred Russel Wallace: Letters and Reminiscences*, which says that Wallace was buried in Broadstone, Dorset, on a windswept hill. On the first outing that I had with my wife-to-be, we happened to be camping in that area of Dorset and I had just read this, so we ended up going to find Wallace's grave. After some searching, we eventually discovered it behind a huge conifer; it was marked by a strange monument, which looks a bit like a phallus on a stone base.

I decided to find out who owned it because I felt it was a shame that it was in such bad condition—you had to climb inside the tree in order to see the name plaque, and the roots were tipping it over. I contacted the cemetery and they said that Wallace's grandsons still owned the grave—I hadn't realized that any of his grandsons were still alive. I managed to find the address of his grandson Richard and wrote to him, saying that I'd seen their grandfather's grave was in a sorry state. He wrote back saying something like, "Yes, it's a great shame. We do our best, but we're

getting kind of old and we go there once a year to clear shrubs and brambles from the base." As Wallace is one of the greatest figures in the natural sciences, at least in biology, I decided that his grave should be restored. I started the Wallace Memorial Fund in order to raise the money to do this and extend the lease on the plot. I'd discovered that the lease only had another fourteen years to run, after which time they would use the plot for another burial and dispose of the monument.

I sent articles to various places telling them about the fund and that I was looking for donors. Within a pretty short time we had over 100 donors from all around the world, which enabled us to restore the monument, cut down the tree that was pushing it over, put up a new bronze plaque explaining who Wallace was, and extend the lease on the plot. By this stage I was in touch with various people in places where Wallace had lived and they were really interested in participating; working with them, we set up other monuments.

AS

Tell us more about how Wallace collected and identified his 125,660 specimens?

GB

There are actually people who know very little about natural history who think that Wallace had an easy time, that he sort of just picked out the insects that flew into his hair as he wandered around. In reality, how Wallace went about collecting was an incredibly skilled practice that very few people in the world could do as well as him, even today. He was primarily gathering specimens for his private collections. He always made that very clear, both in his work in the Amazon and in the Malay Archipelago. He was very interested in geographic distribution from early on, and wanted specimens of many species of insects and birds so that he could study them back in Britain. Whenever he collected a species for the first time, he would keep the first specimen or two for his private collection, and only when he had duplicate specimens would he sell them.

We know he didn't collect many of the same species because it wouldn't have made sense financially. He must have had an incredibly good memory, and not having a camera he had to remember each and every species he collected so he wouldn't collect them



Fig. 02. A page from Wallace's copy of Bonaparte's *Conspectus*. Courtesy of the Linnean Society London. Photo by Etienne Turpin.

over and over again. He was able to identify most of the bird species he collected using a book he had with him: Lucien Bonaparte's *Conspectus*. [Fig. 02.] Rather incredibly, this book has no pictures in it, only brief Latin descriptions of the birds. Even today a top bird specialist would find it incredibly difficult to use a book like that to identify species in the field. But Wallace obviously had a remarkable grasp of the distinguishing characteristics of birds, and using the brief descriptions in this book, he was able to visualize exactly what the species looked like. Even if you have a modern bird book with photographs or illustrations, it is difficult enough to determine what you've seen. Yet we know that Wallace accurately identified many birds and realized which were yet unnamed species. He named and described a lot of the new species himself, and sent off others he believed were new with instructions for Stephens. Often Stephens would then contact the bird people at the museum and they would buy and name them.

For insects, all he had was a book that described the known species of two families of butterflies: *Pieridae* and *Papilionidae*. It was in French and had no illustrations, yet as with his bird book he was able to identify most of the butterfly species he collected. With all the other insects, he memorized what they looked like when he collected them. I have a good memory for that too, and can remember nearly all of the insects I have ever seen—the interesting ones at least! Because Wallace had a photographic memory, he could remember all the species of insects from each island without having to assign scientific names to them. Since most of the insects he was collecting didn't yet have scientific names anyway, Wallace would just need to know whether he had them yet or not.

He assigned a number to each of the species he collected in a particular place and listed the numbers in his collecting notebooks, sometimes with a few notes about the species—two of these notebooks are in our museum here, and one in the Linnean Society's library.

ET

How would you describe Wallace's reliance on local knowledge of the species he was collecting? In a way, he was completely out on his own, with one or two books to guide him; so, did he depend on knowledge from local inhabitants on the islands?

GB

Yes, and no! He certainly depended on local people to collect specimens for him, and they often had valuable knowledge about the habits of the species they were collecting, especially if they were useful to them for food, customs, etc. However, the local people were obviously not scientists, and they certainly didn't know stuff like which species had so far been given scientific names. Wallace's assistant, Ali, for example, was about as far from being a scientist as one could be. He was illiterate and had no scientific education, so to say he "discovered" a species such as Wallace's standardwing bird-of-paradise is simply incorrect! Knowing that a species is new to science requires an in-depth knowledge of the published descriptions of the species in the groups that have already been named, and these descriptions are often difficult to interpret, even for specialists. Ali had no knowledge of these and couldn't even read them. When he collected the first specimen of the standardwing on Batchian island, it was new to him, but he had no way of knowing whether or not it was new to science. Only Wallace knew that the species had not yet



Fig. 03. Detail of one of the maps in Wallace's book *The Geographical Distribution of Animals* (1876). Courtesy of the Linnean Society London. Photo by Etienne Turpin.

been described and named by ornithologists, so it was Wallace who discovered the species, not Ali. Local people must have discovered this bird hundreds of years ago, but we are talking here about discovery in the context of science, not personal discovery.

There's a much more complicated relationship between the scientific descriptions and the species collected than might first appear to certain historians of science. Some tend to be rather politically correct these days and say that local assistants deserve much of the credit because they really understood the animals and they were key to the whole process. However, it's a bit like saying that Darwin's gardener deserves a share

of the credit for Darwin's great work on carnivorous plants because the gardener helped to grow them. John van Wyhe even says in his book *Dispelling the Darkness* that Wallace may have got his inspiration for the Wallace Line from a local person he stayed with on Lombok.¹ In reality, the local people really didn't have a clue about major biological patterns like that. So no, it was only Wallace with his detailed scientific knowledge who would have seen the significance in species breaks and continuums across the islands of the region. He knew that cockatoo diversity was centered in Australia and that one species reached Lombok, but no further west; that marsupials were found to the east of

Lombok, but not to the west; that tigers, elephants and rhinos were found to the west, but not to the east, etc. Furthermore, he realized what the likely explanation for these patterns was. What local person would have been able to draw that kind of conclusion?

ET

Maybe this leads us towards geography. What is the importance of Wallace's work on the biogeographical distribution of species?

GB

Well, Wallace discovered what in 1868 was named Wallace's Line, which runs between the islands of Bali and Lombok and then up between Borneo and Sulawesi. Rhinos and tigers occur on the western side of the Wallace Line, whilst marsupials, cockatoos, and birds-of-paradise occur on the other. As Wallace said in one of his early papers, when you look at two islands like New Guinea and Borneo, they seem very similar. They are similar in their climate, and their forests look the same on the face of things, and yet in Borneo you have monkeys, and in New Guinea you have tree kangaroos and other marsupials filling the monkey niches. This was Wallace's key argument against Charles Lyell's idea regarding "centers of creation," which held that over geological time, as climates changed, God would create species fitted for the new environment. For Lyell, if the climate changed from a desert to a rainforest, then God would create a whole bunch of monkeys. But this wouldn't explain why everywhere to the west of Wallace's Line there are monkeys but to the east there are tree kangaroos and other marsupials instead. Same climate, east and west. So why would God create different organisms to live in trees and eat leaves in such similar places? Why not just

create monkeys everywhere? The answer was down to evolution by natural selection, coupled with geographical barriers to dispersal.

AS

You've briefly mentioned earlier that after Wallace returned from Southeast Asia his work also included envisioning a mode of display for the museum that would show a continental evolutionary panorama of the species. Did he also have a certain curatorial agenda, so to speak? Could you tell us more about that?

GB

Well, he did—unsuccessfully—apply for a position as the director of the British Museum of Natural History, which was to be at Bethnal Green. The collection used to be at the British Museum with all the archaeology and ethnography, but they wanted to make a new museum to house just the natural history. The curious thing is that Wallace sent Richard Owen drawings of how to arrange a museum of natural history, and the ideas in them are strikingly similar to the way our museum in Kensington is actually designed. You can almost imagine Owen actually taking the ideas directly from Wallace. You have to look at the drawings because they're incredibly similar to our main museum building. [Fig. 04.]

ET

Do you have the original correspondence?

GB

No, I don't think so. This was before the museum was built. Wallace wrote a paper about the design of natural history museums.² He was the first to suggest that animals from one particular place or habitat should all be displayed together in order to give a

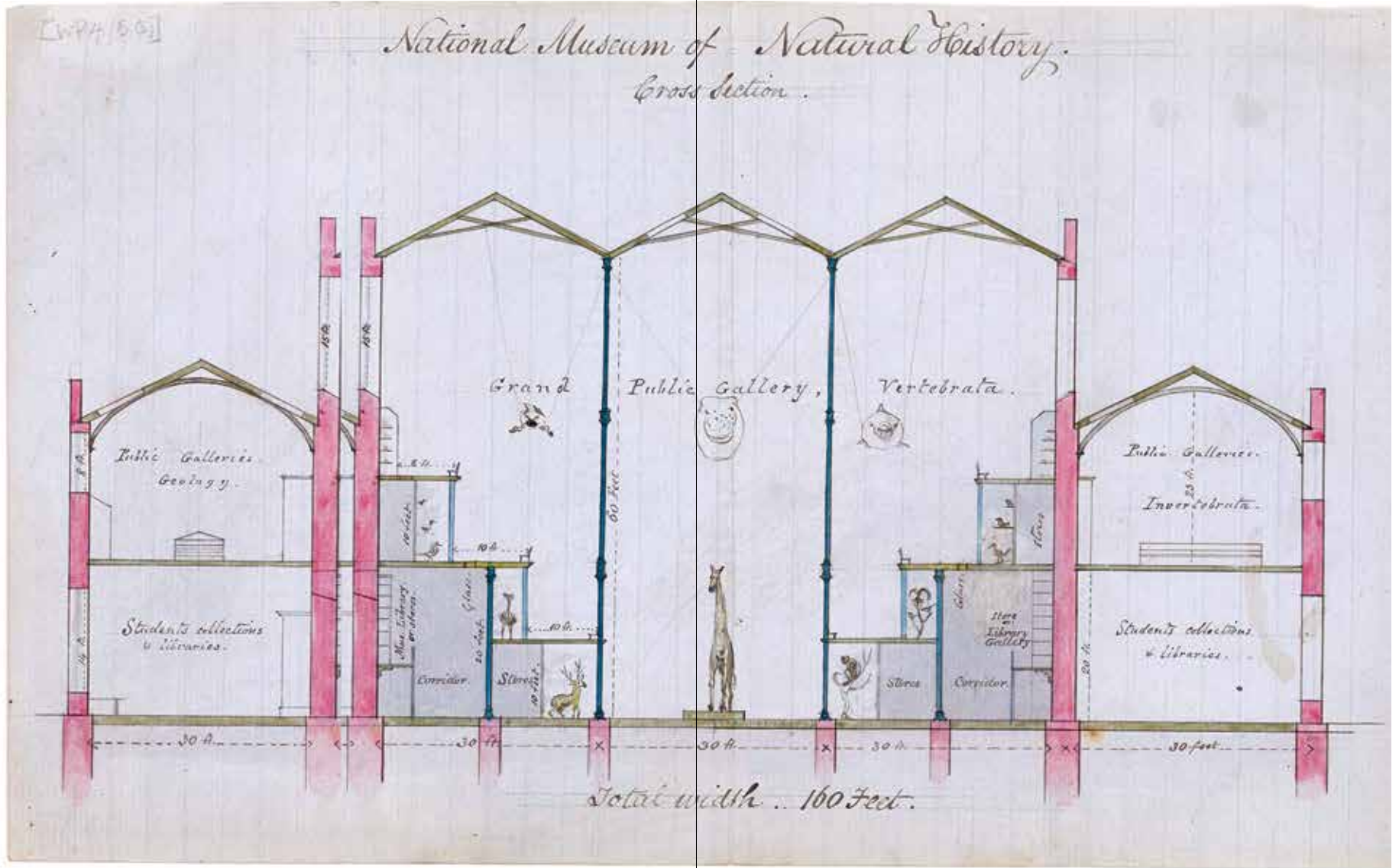


Fig. 04. "National Museum of Natural History (Cross Section)," drawing by Wallace (1864) prior to the founding of the London Natural History Museum. Reproduction courtesy of George Beccaloni and the Wallace Correspondence Project, London. Copyright: Natural History Museum, London & A.R. Wallace Literary Estate.

↘ Fig. 05. Page 45 of the *Journal of the Proceedings of the Linnean Society* from August 1858, which contains the first public representation of Wallace's and Darwin's visions of a theory of evolution by natural selection. Courtesy of the Linnean Society London.

sense of the fauna in that area. Museums like ours and the Powell-Cotton Museum, which still has the best faunal dioramas in Britain, obviously took up this idea. I think the American Museum of Natural History in New York has the best faunal dioramas anywhere in the world. Unfortunately, there are none in our museum anymore. There used to be some in what's known as the Rowland Ward Pavilion—Rowland Ward, the taxidermy company, produced these dioramas free of charge for the museum with the agreement that they would always be there on display. However, about ten years ago or so, the museum broke this agreement and destroyed them.

E T

Why? Aren't they of some historical value?

G B

They were just too old-fashioned. The museum needed space for storing old wooden cabinets and things. There was a beautiful display of a scene on the African Plains with a giraffe and giant sable antelope and then one of the Congo forests with other animals. It's a shame they were destroyed. As for the faunal diorama idea, I don't know if Wallace ever published another paper specifically about it or whether it was just present in his book *The Geographical Distribution of Animals*. The plates show a selection of the most striking animals of one place grouped together.

A S

This leads me to another question about curatorial thinking, about the importance of commemorating Wallace. Why is it important for you to bring the memory of Wallace into the grand narratives (especially of Darwin) already dominant in the space?

G B

I think the current story about the theory of natural selection is fatally flawed, and is just a kind of fairy tale. All attention has been focused on Darwin, while the other people who made important contributions have largely been forgotten. After all, Wallace was the co-discoverer of evolution, as he published the paper with Darwin fourteen or fifteen months before *On the Origin of Species* was published. So, in my view, he deserves half the credit—but not only that! He and Darwin almost exclusively, together, laid the foundations of modern evolutionary biology and all the other add-on theories in the early days, like understanding animal coloration in an evolutionary context, biogeography, etc. You know, if you think about the lasting scientific achievements of some of the prominent biologists of the nineteenth century, like Ernst Haeckel and Thomas Huxley, you can't really come up with anything. No major theoretical ideas that they developed have lasted to this day, whereas both Wallace and Darwin made major contributions that still endure.

A S

So there's a concern for historical accuracy, but what about those aspects of the narrative in which Wallace differs from Darwin. For example, Wallace is sometimes called the father of conservationism. He was very outspoken on certain issues which we'd now call conservation, which seem quite relevant for contemporary purposes.

G B

Personally, I think that Wallace's role as an environmentalist has been a bit exaggerated. He didn't really write that much about it. However, what he did write was very powerful and probably far ahead of its time. For people like Darwin, on the other hand, it was wonderful that all the natural habitats

On the Tendency of Species to form Varieties; and on the Perpetuation of Varieties and Species by Natural Means of Selection. By CHARLES DARWIN, Esq., F.R.S., F.L.S., & F.G.S., and ALFRED WALLACE, Esq. Communicated by Sir CHARLES LYELL, F.R.S., F.L.S., and J. D. HOOKER, Esq., M.D., V.P.R.S., F.L.S., &c.

[Read July 1st, 1858.]

London, June 30th, 1858.

MY DEAR SIR,—The accompanying papers, which we have the honour of communicating to the Linnean Society, and which all relate to the same subject, viz. the Laws which affect the Production of Varieties, Races, and Species, contain the results of the investigations of two indefatigable naturalists, Mr. Charles Darwin and Mr. Alfred Wallace.

These gentlemen having, independently and unknown to one another, conceived the same very ingenious theory to account for the appearance and perpetuation of varieties and of specific forms on our planet, may both fairly claim the merit of being original thinkers in this important line of inquiry; but neither of them having published his views, though Mr. Darwin has for many years past been repeatedly urged by us to do so, and both authors having now unreservedly placed their papers in our hands, we think it would best promote the interests of science that a selection from them should be laid before the Linnean Society.

Taken in the order of their dates, they consist of:—

1. Extracts from a MS. work on Species*, by Mr. Darwin, which was sketched in 1839, and copied in 1844, when the copy was read by Dr. Hooker, and its contents afterwards communicated to Sir Charles Lyell. The first Part is devoted to "The Variation of Organic Beings under Domestication and in their Natural State;" and the second chapter of that Part, from which we propose to read to the Society the extracts referred to, is headed, "On the Variation of Organic Beings in a state of Nature; on the Natural Means of Selection; on the Comparison of Domestic Races and true Species."

2. An abstract of a private letter addressed to Professor Asa Gray, of Boston, U.S., in October 1857, by Mr. Darwin, in which

* This MS. work was never intended for publication, and therefore was not written with care.—C. D. 1858.

were going to be replaced by monocultures; he thought that was progress. Wallace sometimes thought like that, but he realized that there would be a major loss of scholarship if all these species were destroyed by development. He was, for example, passionate about the giant redwoods and horrified by their destruction in America. He even went to see them and met the pioneer of American conservationism, John Muir. Wallace was ahead of his time in that respect, but he didn't really focus his work on environmentalism or conservationism. I suppose that back then it was far less of an obvious problem; it wasn't nearly as serious as it is today.

AS

We are eager to know whether the species Wallace collected can still be found today, and if one could currently come up with the theory of natural selection based on available specimens, given the habitat loss one encounters in certain parts of Indonesia?

GB

Actually, very few of the species of insects and birds that Wallace collected in Southeast Asia are known to be extinct. I can't think of any, in fact. Many of them are probably much rarer than they were, but if you had all the official permissions you could still make collections like Wallace's today. But it would be impossible now to travel from island to island shooting every bird you wanted—the permission would not be granted. Anyway, collecting birds is not done very often these days. So, the birds are still there, and you could go to Halmahera and kill a whole lot of Wallace standardwings if you had permission. But that wouldn't be a very responsible thing to do given how rare they are. With insects, it's a different picture because, in general, you can't collect enough of one particular

species to damage the population. At least it's pretty difficult to do so. Entomologists are still very active in Indonesia, collecting and studying insect species, just as Wallace did, but with much better facilities.

ET

So, even though larger mammals are extinct or rare, there's still a wide array of living evidence for natural selection?

GB

Sure, it's just that the political situation has changed. It would actually be impossible today to travel wherever you like and collect what you wanted. So, say for example that the Wallace Line hadn't yet been discovered. There are two ways you could discover it today: either by doing all the collecting yourself, or by reading enough about the distribution of animals in that region. You might be able to work it out just by understanding the patterns of distribution of various animal groups.

ET

Is taxonomy changing as a result of new forms of DNA analysis?

GB

Not as much as you might think. It tends to be that DNA studies confirm what expert taxonomists have always thought, or at least that seems to be the overriding trend. A good example is some work that I did on cockroaches and termites; I initiated a big DNA study of these critters, and we finally proved that termites are actually cockroaches that have evolved to be highly social. In fact, this was first proposed in the 1930s using obscure morphological characteristics like the structure of the gizzard and the protozoa in the guts of termites and cockroaches—very technical, anatomical things. This is the cockroach tree. [Fig. 06.] Rather than being an

outlying group, termites have arisen from within the tree. Since then, other DNA and RNA studies have confirmed our findings. Anyway, all of this is to say that we reinforced what expert morphologists realized a hundred years ago.

ET

What about mimicry? This idea has been very important for discussions of natural selection; have these discussions been changed by more recent DNA or RNA studies?

GB

Well no, not much anyway. Color patterns and mimicry were the first great tests of the natural selection theory. If you look at the early papers on the topic, they used mimicry as an example because it was clear—one species has evolved to look like another because it's tasty and the other's nasty. All of the arguments were centered around these visual examples, and mimicry was of great interest. Wallace proposed a lot of the ideas that are still valid today about animal colors, and he discovered sex-limited polymorphic mimicry in butterflies, where one species has females that look like members of several other different

species living in the same habitat. In one species of swallowtail butterfly, for example, males all look the same and aren't mimetic, but the females have various morphs that each mimic a different species of poisonous butterfly. Wallace was the first person to explain this.

AS

Can you explain the significance of this?

GB

Well, there aren't discrete morphs among humans. We're mixtures of our parents; whereas with butterflies, there's one kind of male with, say, black wings, and then five different female color patterns, each of which has evolved to look like a different species of poisonous butterfly. When they breed, you always get the same males and this array of different female patterns. That's why it is called sex-limited polymorphic mimicry. Wallace discovered this in the Southeast Asian swallowtail butterfly, *Papilio memnon*, but it became more famous when something similar was discovered in another swallowtail species called *Papilio dardanus* in Africa. It was then studied for a hundred years and

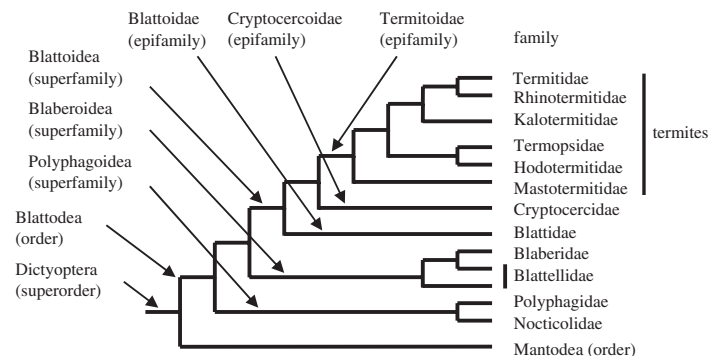


Fig. 06. Proposed epifamily classification shown on the tree topology, from Inward et al., "Death of an Order: A Comprehensive Molecular Phylogenetic Study Confirms that Termites Are Eusocial Cockroaches," *Biology Letters* 3 (2007): 564–65.

still, to this day, researchers are trying to work out how the different mimetic morphs actually arose, and the genetics of the process. Wallace must have gotten a batch of eggs, reared the caterpillars, and saw that they produced black males and five different types of females; he realized that all these females he thought were different were actually of the same species.

A S

Didn't Wallace reject Darwin's theory of sexual selection?

G B

Interestingly, the modern theory of sexual selection actually has more to do with Wallace's ideas than Darwin's. Everyone says that Darwin came up with the theory of sexual selection and Wallace rejected it, but if they knew enough about the modern theory, it's actually quite the reverse!

A S

Can you explain more about these two theories?

G B

Darwin's theory says that the females of a species have an appreciation of beauty and that they pick the most beautiful males to mate with because they deemed them to be *beautiful*. Wallace couldn't imagine that a butterfly would have an aesthetic sense. Why would a tiny insect brain be able to judge beauty in this way? Wallace's alternative idea was that the plumage, in birds for example, had some other function. It was basically the fittest males who were able to produce the best plumage, which was a sign of vigor and health. So, by choosing the best plumage the females were choosing the healthiest males. Or, in the case of antelopes, say, it would be the males with the biggest horns who were

chosen by the females because they knew their offspring would have those characteristics. That's what the modern theory of sexual selection is all about, which follows from Wallace's "good genes" argument for selection, as opposed to the aesthetic sense idea of Darwin. In sexual selection, for Wallace, "beauty" is a reliable indicator of health and vigor, not an aesthetic quality chosen for its own sake.

A S

Continuing from here, can you summarize what distinguishes Wallace from his contemporaries? Why is he so special in the history of science?

G B

He came from a poor family and was largely self-educated, yet he achieved really great things. When people think of Wallace—if they think of him at all—they think of the Wallace Line, or maybe even the co-discovery of natural selection, but his legacy goes far beyond that. His contributions to biology are very important, much more so than most of the other people in his day, such as Joseph Hooker or T. H. Huxley, even. Only Darwin made similar contributions. Let me read you something I recently wrote on this:

"Wallace's contributions to biology went far beyond *merely* co-discovering the theory on which the modern science is based. Unlike Darwin, he always rejected Lamarckism—the inheritance of characteristics acquired during the life of a parent, like the enlarged biceps developed by a blacksmith over the course of his career. In fact, he was the first natural selectionist to reject this flawed theory and he was therefore, ironically, the first neo-Darwinian. Wallace devised the first modern definition of what species are—a slightly modified version of

which would later become known as the Biological Species Concept; in addition, he believed that speciation typically occurs in allopatry or parapatry, when diverging populations are geographically separated or abutting. He also proposed what is known as the Wallace Effect (also called Reinforcement) to explain how natural selection against hybrids between incipient species could contribute to reproductive isolation and hence speciation. Darwin, by contrast, believed that speciation occurs largely as a result of competition in sympatry (within the same habitat), a theory he called his Principle of Divergence. Given that it is now thought that most speciation is a consequence of geographical isolation, Wallace was therefore more correct about the origin of species than Darwin was! Interestingly, although many think of sexual selection as being Darwin's theory, Wallace's 'good genes' argument to explain the evolution of sexual characteristics is regarded by many scientists today as more plausible than Darwin's belief that females choose mates on aesthetic grounds. Even the concept of warning coloration in animals (e.g. where caterpillars have evolved conspicuous colors to advertise their toxicity to potential predators) and the idea of the Great American Interchange (where animals from South America moved into North America and vice versa, when the two previously isolated continents were joined together by the formation of the Isthmus of Panama about three million years ago) were theories originally conceived by Wallace."³

There are other things, too, like recognition marks in animals; a scientific paper about facial patterns in monkeys recently confirmed Wallace's theory of recognition marks. He was also the founder of astrobiology; he came up

with the first plausible evolutionary idea of aging and death; he was first to propose mimicry in birds and in snakes, and mimetic polymorphism in butterflies. Then there was the Wallace Line, of course, and the fact that he collected about 19,000 species new to science in the Malay Archipelago.

A S

Can you explain more about the Biological Species Concept? Wasn't that Ernst Mayr's idea?

G B

People often believe that Mayr came up with the Biological Species Concept, but he actually took it from Wallace, who was the first to claim that species should be defined as interbreeding groups that are reproductively isolated from other such groups. Incidentally, there's nothing in *On the Origin of Species* that actually explains what a species is. So, even though it's a book about their origin, Darwin never defines what he means by species.

A S

Do you think there is a way that the study of Wallace could contribute to the current discussion of the Anthropocene?

G B

I'm not sure, but I think it should be called the Destructocene.

- 1 John van Wyhe, *Dispelling the Darkness: Voyage in the Malay Archipelago and the Discovery of Evolution by Wallace and Darwin* (Singapore: Scientific World, 2013).
- 2 See Alfred Russel Wallace, "Museums for the People," *The Alfred Russel Wallace Page*, <http://people.wku.edu/charles.smith/wallace/S143.htm>.
- 3 Charles H. Smith and George Beccaloni, eds., *Natural Selection and Beyond: The Intellectual Legacy of Alfred Russel Wallace* (Oxford: Oxford University Press, 2010).



The Teak Bed
That Led
Four Humans
to Travel
from Singapore
to Muna Island,
Southeast Sulawesi,
and Back Again

by Lucy Davis

Is it possible to trace the geographic origin of the wood from an old teak bed using DNA-tracking technology typically applied to determine whether timber comes from legal or illegal logging sites in Southeast Asia? This was the question inspiring the artist Lucy Davis and her interdisciplinary collective, The Migrant Ecologies Project, when she found an old bed frame in a junk store in Singapore's Little India. In an exploration undertaken in collaboration with photographer Shannon Castleman, the bed thus became the starting point for a tracing of the multiple cultural and economic meanings of teak in the Malay region. While it proved to be especially difficult to make any certain claims about which precise forest area the teak wood originally came from, the journeys that unfolded as part of the search opened up a field of forest-culture connections, some of which are unfolded in the following pages. A related series of black-and-white photographs Castleman also produced during these journeys is published in the fourth volume of this publication series, *The Word for World is Still Forest*, 86–95.

Fig. 01. Lucy Davis, *Ranjang Jati: The Teak Bed that Got Four Humans from Singapore to Travel to Muna Island, Southeast Sulawesi and Back Again*, Wilton Close, Singapore, 2012.

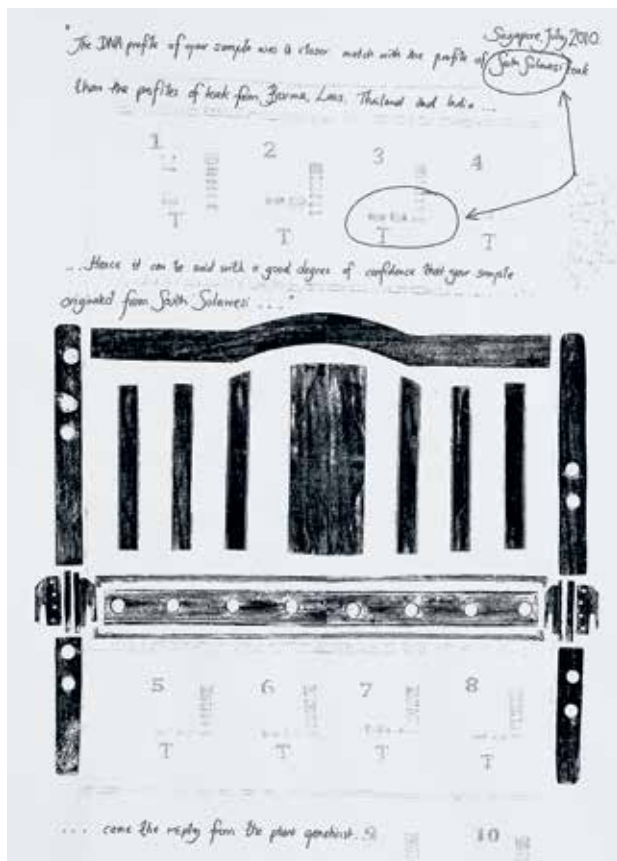


Fig. 02. *Ranjang Jati*. Another of Davis's woodprint collages (2012), here including a print-out of the bed's DNA profile.

Fig. 03. A woodprint collage reproduction of the thumbprint of David Tan, a *karang guni*, or collector of household items typical for Singapore. He sold the 1930s bed frame in his junk store in Rangoon Road in the city's Little India district. This artwork (2013) is one of a series of prints Davis created by collaging-together small fragments of prints made with the bed's wood.



Fig. 04. A flower of the teak tree, or *Tectona grandis*, in a woodprint collage by Davis (2013) after William Roxburgh, *Plants of the Coast of Coromandel*, vol. 1. (London: W. Bulmer and Co., 1795). Plate 6.



Fig. 05. A "talisman" with a sample from the bed's wood that was used to extract its DNA. During the journey to Muna Island, the collective wore the samples around our necks and hung one on the oldest teak tree they found on the island.

Due to its durability, structure, and natural water-resistance, teak has been used for centuries to manufacture carpentry products, including boats, furniture, and interior and exterior architectural elements. Endemic to South Asia—and possibly some areas in Southeast Asia—the wood became an especially popular export in the twentieth century, leading to the expansion of mono-crop teak plantations and increased deforestation due to selective logging in the region. Like any other living organism, each tree can be identified by its unique DNA signature, also called its "fingerprint." The Singapore-based start-up Double Helix Tracking Technologies uses their DNA-fingerprinting technology to certify the legality of timber by determining lumber's site of origin.

In our exploration, the Migrant Ecologies Project collaborated with

Double Helix to determine the origin of the second-hand teak bed. Preliminary tests suggested a possible connection between DNA from the bed and teak in southeast Sulawesi [formerly called Celebes]. This insight was based on a theory that teak, cultivated and logged in Indonesia for centuries, had "naturalized" in southeast Sulawesi and that this process might be evident in its genetic structure.

A parallel, art-historical inquiry concerned our fascination with the mid-twentieth-century Malayan "modern" woodcut; we were interested in working with the micro-gestures of woodcut styles to describe the contemporary macro-ecological context of regional deforestation. As a result, most of the woodprint works that emerged from this five-year investigation were compiled of prints made with the teak bed's wood.

Before visiting Muna Island, we didn't entirely grasp teak's historical impact on land use, which produced environmental and social transformations similar to those unleashed by contemporary oil palm plantations in Malaysia and Indonesia. According to Dr. La Ode Sirad Imbo, a local historian and philologist from Muna, teak originates from Burma, India, and Laos, but was introduced to the island more than 500 years ago. Legend has it that teak seeds were gifts from Javanese royalty to the King of Muna. Initially, only the King could plant teak, with severe penalties for those caught smuggling seeds. Later, intensive cultivation was the purview of the Dutch, who carried out most of the large-scale deforestation in the area. After Indonesian Independence in 1945, plantations were controlled by the Indonesian state.

We heard a saying on the island: "Politik Muna adalah politik kayu" [Muna politics is a politics of wood]. Today, virtually no original forest remains. The decades from the 1950s to the 1990s were timber boom years where demand exceeded supply and sawmills lined the harbor of the main town, Raha. Today, although these sawmills are still standing, they are overgrown with weeds because there is no timber left to sell and forest destruction has significantly affected the water table, diminishing the available freshwater.

Alongside these stories of macro-ecological change, we were committed to drawing out various related micro-gestures. Things got complicated. While subsistence farms produce food for local consumption and fishing occurs along the coast, the mainstay of Muna's economy is still teak. Due to regulations on logging meant to curb overconsumption, this meant that until the early 2000s, if one were to survive



Fig. 06. Logging in a Konservasi Forest: Scenes from an Island after a Timber Boom. Photo by Shannon Castleman from Muna Island, Southeast Sulawesi, 2010.

on a teak economy, one had to do things that were "illegal"—at least according to the discourse of DNA certification. For this reason villagers would for instance make it their practice to cut more teak than they needed for themselves and built houses with double walls, as well as keeping extra stock underneath their

homes for "repairs." After the fall of President Soeharto in 1997, villagers were eventually permitted to plant their own trees. But, because teak trees can only be harvested after twenty or thirty years, many trees in these smallholder plantations for a long time have remained too young to harvest. Instead, illegal logging of recently

established *konservasi* forests—plantations awarded "conservation" status in order to protect groundwater—became widespread. Indeed, as explained below, the only *konservasi* forests left untouched by woodcutters are those they believe are haunted.

Good building timber would appear to be scarce in Java. The Java Bode makes the following announcement:—As there are repeated complaints by building contractors at Batavia about the lack of good building timber, we may state that on the 22nd inst. there will be an auction in the suburbs of about 200 cubic meters of fine jati logs which have come from the Government forests in Moena (Celebes).

↑ Fig. 07. Clipping, *The Straits Times*, 10 January 1907.

SITUATION IN CELEBES. Striking Advantages of the Argument of Force.

Optimists in Java look with pleasure upon the results of military operations in Celebes within the last three years, to enforce peace and order among vassal states, upon which hitherto Dutch authority had sat lightly.

In many parts, the authority of Government is established so firmly now that the people are beginning to pay taxes regularly, with the gratifying result that the island is no longer a burden upon the Government. This especially is the case in North West Celebes—the land of the Bugis, an enterprising and commercial race. Their roads and telephone lines are in course of construction. Trade has increased, and steamers now call at places where, formerly, small vessels met all commercial needs.

The district of Boni has been found to be suited admirably to tobacco cultivation. On the coast, in several outlying parts, a brisk trade has sprung up in jungle produce, which, in former days, could not be exported owing to feuds between the coast dwellers and the inland tribesmen.

On the East coast, trade is developing rapidly. The South-East peninsula of the island, which is almost unexplored, is being opened up, with timber and rattan as important articles of export. Wild tribes inhabit the interior. On the islands of Buton and Muna, where the slave trade lately flourished, an export trade in oak and copra has sprung up. The Government has just gained a foothold on the West coast of Central Celebes, where it has begun the construction of a high road.

This part of the island is rich in copra. The Java Bode says that this progress is due mainly to a wise system of decentralisation, which admits of the local revenues being spent to local advantage. The military force, which accomplished these wonders, is hardly 2,000 strong. The slave traders, robbers, and rowdies feel the yoke keenly, and the mass of the people, who hitherto had done what was right in their own eyes, are only kept under by fear of the strong arm, but a good beginning has been fairly started

OUR NEIGHBOURS.

Slavery in Celebes.

The Dutch Government is taking strict measures to put an end to slavery in the conquered districts of Celebes. Officials go round to free the slaves and to warn the slave traders. The slaves are told to go back to their homes. Many of them had been so long away that they preferred to stay. To such, leave was given to remain, and to settle down in villages of their own. The officials, who visited the island of Muna, the favourite hunting ground of the slave dealers, found a terrible state of affairs. The poor islanders were so demoralised and dispirited by continual raids that they looked upon slavery as their destined lot, and scarcely dared to withstand the slave-hunters.

↑ Fig. 08. A reprint of an alert originally published in the *Batavian Java-Bode* [Java Herald]; clipping, *The Straits Times*, 29 June 1911.

← Fig. 09. Clipping, *The Straits Times*, 28 March 1908.

TIMBER PRODUCTS S'PORE'S FIFTH LARGEST EXPORT

THE wood products industry is now Singapore's fifth largest export item, preceded only by petroleum and petroleum products, rubber, electrical machinery, textiles and textile products, the Deputy Trade Director, Mr. Leong Chee Whye said yesterday.

Opening a five-day workshop on export development of furniture and wood products to the United States at the Holiday Inn, he said there were over 200 establishments in the wood products industry.

Like all industries here, the wood products industry was undergoing rapid changes and modernisation, he said, adding the industry was investing in more sophisticated capital intensive machinery and upgrading their workers' skill.

Increase

The range of wood products manufactured here had increased and diversified to include higher value added products, among which were knocked-down furniture, oriental and ornamental furniture, furniture components and decorative plywood.

He said that last year, Singapore's total exports of timber and timber products rose to \$57.4 million from \$34.7 million in 1975, an increase of 67.5 per cent.

Its exports of furniture more than doubled to \$33.6 million from \$15.4 million the previous year.

The fastest growing market for Singapore's furniture was the United States, he said and added that last year, the US purchased \$12.7 million of furniture from here, five times more than the previous year.

Timber trade exports soar past billion dollar mark

SINGAPORE timber industry exports crossed the billion dollar mark for the first time last year.

A total of 2.09 million cubic metres of timber and timber products worth \$1,156 million were exported during the year.

This is also the first time that the total export volume crossed the two million cubic metre mark. Compared with 1978, this represents an increase of 11 per cent in volume and 50 per cent in value.

Much of the increase in value last year was attributed to inflation and to the higher costs of raw materials and production.

According to the latest issue of the *Timber Digest*, a monthly publication of the Timber Industry Board, Singapore's total exports of timber and timber products reached a record level of 182,511 cubic metres valued at \$118.5 million in December last year.

This is an unprecedented record for a single month's performance in terms of value last year.

Plywood

In terms of volume, it was exceeded only twice—once in January 190, 276 cubic metres worth \$83.74 million) and another time in May (203,341 cubic metres valued at \$106.6 million).

Plywood exports also reached record level in December and most of these were timed to reach Britain last month when the new Generalised System Preferences quota began.

The total volume of sawn timber exported in December amounted to 114,032 cubic metres valued at \$56.4 million, an increase of 5 per cent in volume and 6 per cent in value when compared with exports in November.

The president of the Singapore Sawmillers' Association, Mr Fong Pin Chee, said he expected the prices of sawn timbers to rise soon.

The prices dropped by between 15 and 20 per cent during the second half of last year.

At present, there are 42 sawmills at the Kranji/Sungei Kadut industrial estate. Four or five years ago, before they were relocated, there were about 100 sawmills in Singapore.

← Fig. 10. Clipping, *The Straits Times*, 16 August 1977.

→ Fig. 11. Clipping, *The Straits Times*, 22 February 1980.

Tales from Two Islands:
After a Timber Boom



Fig. 12. An advertisement for Diamond Bedsteads. Clipping, *The Straits Times*, 12 January 1937.

In the early twentieth century, the Dutch are known to have used slavery and suchlike as excuses to move in and monopolize the resources of various parts of the archipelago. Both Sulawesi and Muna produced very "fine jati logs" [Fig. 07.] and other riches, which are often entwined with stories of slave raids on the islands and rebellions on the mainland. During these events, *The Straits Times* of Singapore sometimes seemed supportive of Dutch efforts to end slavery, improving island folks' living conditions. [Fig. 09.] But other times the same newspaper would also voice its support for the efforts of the Dutch to intensify their colonial control. [Fig. 08.]

A search through the Singapore National Library's online newspaper archive turned up an advertisement from 1937 of the very bed's model found in the store on Rangoon Road in 2009. Diamond Metal was a company set up by long-term local rubber traders Francis Graham and Vernon B. Jepson in February 1927. They produced bedsteads, trunks, and batteries. The teak wood in the advertisement is somewhat incidental as the actual purpose of the ad was to promote the innovative use of metal for the bedstead's central part. However, it is quite certain that our bed was indeed the same model shown in the photograph, as a careful examination revealed the same diamond formation of the timber on the centerboard. [Fig. 12.]

Figs. 13–15. These historic photographs of the teak industry on Muna are reproduced with kind permission of Walter T. Bermuli, a former sawmill engineer from Raha, Muna. All photographs are undated but taken on the island during the 1930–60s.



The timber boom continued through the 1970s and 1980s. [Figs. 10–11.] "During those days, everybody worked in the teak plantations. We used buffalo to drag the teak logs. Later there were lorries and cranes with caterpillar wheels. So we sold all our buffalo to traders from Toraja. There are very few

buffalo left on Muna now. During those busiest years even the rivers were thick with teak logs. You could walk on wood all the way to the sea," the head of the Muna village Pentiro told us in 2010. [Figs. 13–15.]



Fig. 16. Still from Davis's animation film *Jalan Jati (Teak Road)*, 2012. This woodprint collage made with the bed's fragments depicts a scene of naval traffic during the timber boom in the early twentieth century.

Divining Wood: Magic and Science, Banyan and Teak

Upon our arrival, the only *konservasi* plantations left standing on Muna were those considered to be inhabited by spirits. In these *hutan-hantu* [haunted forests], strange battles ensue between remaining teak trees and the banyan, or strangler's fig, a parasitic vine.

The banyan seed is in most instances dispersed in the canopy by a bird or a bat. The plant puts out aerial roots which, upon reaching the ground, enforce a complex cage-like architecture that suffocates the host tree. Residents throughout the archipelago consider the banyan to have potent powers, possibly due to the imposing way it “possesses” other trees.



Fig. 17. *Banyan and Teak, Muna, Southeast Sulawesi*. Woodprint collage also made from the bed by Davis, 2013.



Fig. 18. *Dukun-dukun* examining the teak bed samples.

The ability to divine whether a tree or piece of wood has spirits is the purview of *dukun-dukun*, traditional arborealists or wood-spirit shamans. A *dukun* is consulted on matters of healing and fortune-telling. They traditionally advise whether a tree should be chopped down and which kind of wood has to be used in house construction, providing incantations for the process. In Muna architecture—as in many places in Southeast Asia—the root end of a plank must point to the ground and the crown to the sky. For overhead beams, the crown should point towards Mecca. The *dukun-dukun* claim to be able to discern crown or root ends of a piece of wood just by holding the timber.

We presented the bed to two *dukun-dukun* and asked for their interpretation. [Figs. 18–19.] The male *dukun* responded that our teak was *jati-hitam* [black teak] of the lowest grade used only for the lavatory and back areas of houses. The female *dukun* was not as convinced by the DNA reading and claimed that the wood was not from the Sulawesi region.

During these interviews, we met with some resistance from our two Indonesian collaborators—the country manager of Double Helix Tracking Technology and the engineer from the provincial capital of Sulawesi Tenggara,

Kendari, who was our fixer and guide. Both dismissed the claims as animist magic and declared their own Islamic and Catholic faiths to be more modern and scientific. However, an interesting discussion developed after I showed them an earlier animation I had made of Alfred Russel Wallace on my laptop and explained how Wallace had formulated a theory of natural selection independently of Charles Darwin. Although they were not familiar with Wallace, the mention of Darwin sparked a negative response; both pronounced that they did not believe in evolution. They did, however, believe in DNA.



Fig. 19. *Dukun-dukun* examining the teak bed samples.

Patriarchal Imprints



Fig. 20. A woodprint collage reproduction by Davis (2012) of a historic photograph of the Muna teak industry from the collection of Walter. T. Bermuli made of print-fragments of the bed.

Two woodprint collages. The first is a reconstruction of an undated photograph of the late Alex Bermuli, a Muna sawmill owner, in a plantation with a group of men around a tree, upon which he has placed his hand. [Fig. 20.] The second one reconstructs a photograph of Simon Oei of Nature Wood Pte Ltd, Singapore, at around four years old. His father, Allen, a timber merchant, had placed him on top of a huge meranti log in the Danish-run timber yard where he worked in the 1970s. [Fig. 21.]

While contemplating the first image, Walter. T. Bermuli told us his father Alex had migrated to Muna in the 1950s. Walter, himself a retired sawmill engineer, allowed us to re-photograph his collection of snapshots dating from the 1930s. [Fig. 13–15.] The men in

Walter's family had all worked with teak for three generations. His son is now a forest policeman.

Like Walter Bermuli, Allen Oei—whose family migrated to Singapore from the Javanese city of Surabaya before the Second World War—gave us access to his photo album during a surprisingly frank series of interviews detailing his rags-to-riches journey from itinerant timber grader to influential merchant. Oei recounted how, in the 1970s, when local authorities discovered his Indonesian colleague logging illegally in Riau forests for a French company, the colleague burned down the entire forest area to cover their tracks. Oei had also been to Muna and confirmed that Muna teak was superior to any other type found outside of Burma.

Allen Oei, by his son's own reckoning, controlled a significant proportion of the legal and illegal teak trade passing through Singapore in the 1980s and 1990s. But Simon did not recall this childhood photograph being taken. As a young man, he was repulsed by the sweaty, dirty, gangster-like world of the sawmill. He studied computer science at university and worked for a series

of multinationals before joining his father's business at the age of twenty-eight. When we interviewed him in 2014, he was poised to take over Nature Wood under his father's watchful eye, aware of the ecological complexities of his position yet trying to find ways to defend it. "A timber plantation is, of course, an excellent way to contain carbon," he asserted.



Fig. 21. A woodprint collage reproduction by Davis (2014) of a photograph of Allen Oei's son Simon as a child in the 1970s, standing on the grounds of P. Bork A/S International in Kranji, where his father was employed. The printing for this work was made using the Burmese teak logs shown in Fig. 22.



Fig. 22. Teak donated by Allan Oei to the Migrant Ecologies Project.



Fig. 23. Lucy Davis, *Together Again (Wood: Cut) Part V: EVIDENCE*, 2014.

Allen Oei also donated some logs to the Migrant Ecologies Project. [Fig. 22.] These were supposedly among the last shipment of teak logs that were shipped from Burma to Singapore before the Burmese government enforced a ban on the export of whole

logs on 31 March 2014. Letter and number marks were punched into the wood in Burma. They bear information about the grade of the timber and the precise origin of the logs; a star apparently means best quality.

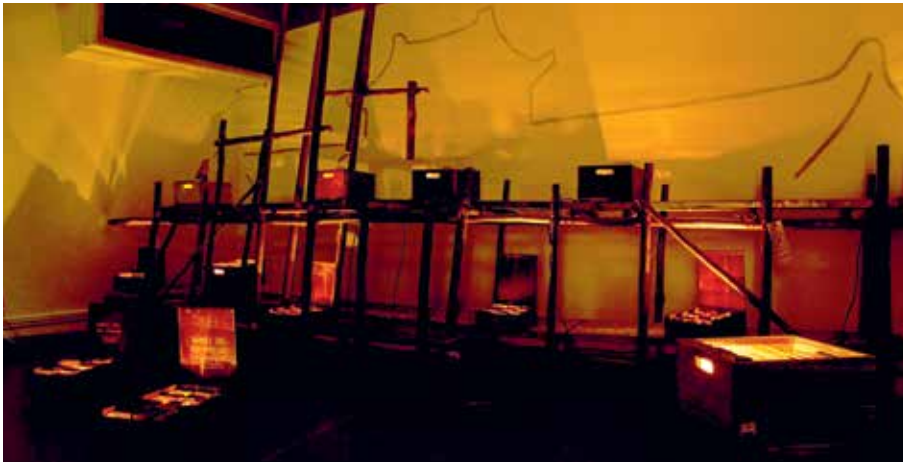


Fig. 24. Exhibition view of the installation *Nanyang University* in the exhibition *When You Get Closer to the Heart You May Find Cracks* by the Migrant Ecologies Project, National University of Singapore Museum, 2014–15.

In addition to the aim of retracing a historical wood object to its forest of origin, another aspect of our project was to rethink the legacies of the modern Malayan woodcut printing movement in the context of contemporary deforestation in Southeast Asia. The display architecture of a room-sized installation entitled *Nanyang University* in our exhibition *When You Get Closer to the Heart You May Find Cracks* (National University of Singapore Museum, 2014) thus purposefully echoed a 1955 woodcut print by Malaysian artist Lee Kee Boon depicting the city's Nanyang University [Fig. 25.] behind traditional *balau* timber, or mangrove scaffolding. Translating that fragile exoskeleton of a scaffold in Boon's picture back into three dimensions, wooden archival boxes were placed inside an actual recycled *balau* scaffolding. [Fig. 24.] This structure evoked the windows of the university building, but also contained shadow-puppet interpretations of other iconic Malayan woodcut works from the mid-twentieth century. Other boxes housed scenes from the 1930s, echoing

the period that the original advertisement for our bed in *The Straits Times* dates back to. [Figs. 12./26. middle] The middle shadow puppets were also made from woodprint collages using either the bed or Allen Oei's teak logs as seen on the previous pages. In this room of shadow-box dioramas, slowly animated by swinging light pendulums, we intended to conjure layers of half-built, still-breathing dreams of wood where the shadow of the last tiger killed in Singapore in 1937 [Fig. 26. bottom], falls under the bed from the Diamond Bedsteads advertisement of the same year.



Fig. 26. Top: Lee Kee Boon's 1955 woodcut print, *Nanyang University*; middle: the advertisement for Diamond Bedsteads from 1937; bottom: and the tiger killed in Singapore's Chua Chu Kang Village in 1937, each reinterpreted by Davis (2014) as woodprint shadow-puppet collages.

← Fig. 25. Lee Kee Boon, *Nanyang University*. Woodprint, 1955 (1999 print).

Jati-diri and the Naming of Names

This photograph [Fig. 27.] shows assorted wood samples that once belonged to the Botany department of the University of Malaya, later the National University of Singapore. No longer used, this collection was given to the Migrant Ecologies Project by the new Lee Kong Chian Natural History Museum, which opened in 2015, on the fiftieth anniversary of Singapore's Independence. The Malay names of the tropical trees are punched into these wood samples: *BALAU*, *BINTANGOR*, *CHENGAL*, *JELUTONG*, *KEMPAS*, *KERANJI*, *MELUNAK*, *MERANTI*, *PUNAH*, and—*TEAK*. Given the rapid deforestation of the archipelago, one wonders whether and how the Malay names of these trees and their attendant stories will be remembered as these species of trees are becoming ever more rare.

Apparently, there are multiple meanings of the Indonesian word for teak, *jati*. “*Jati-diri*” and “*sejati*” are common: “*Diri*” means self, while “*jati-diri*” is often taken to mean identity, personality, or the essence of self. “*Sejati*” means pure, true, authentic, original, or genuine. Such translations of *jati* suggest a layering of our journey—returning via our project to the colonial natural historians and migrant Chinese artists in order to reveal their presence in the archipelago via the adoption of languages, the transcription of forms, and cuttings of wood.



Image Credits

- Fig. 01. Artwork by Lucy Davis. Photograph (by Shannon Castleman) showing the bed frame around the time of the story. Property of National Gallery of Singapore.
- Figs. 02–04. Property of National University of Singapore Museum.
- Fig. 05. Exhibition view, National University of Singapore Museum, 2014–15. Photos by Lucy Davis.
- Fig. 06. Photo courtesy of Shannon Castleman.

Fig. 27. Installation view of historical wood samples in the exhibition *When You Get Closer to the Heart You May Find Cracks* by the Migrant Ecologies Project, National University of Singapore Museum, 2014–15.

- Figs. 07–11. Clippings from the Singapore National Library's online newspaper archive.
- Fig. 16. Reproduction courtesy of the artist.
- Fig. 17. Property of the National Gallery of Singapore.
- Figs. 18–19. Photos courtesy of Shannon Castleman.
- Figs. 20–21, 23. Property of National Gallery of Singapore.
- Fig. 24. Photo by Norman Ng.

Fig. 25. Reproduction courtesy of the National University of Singapore Museum Collection.

Figs. 26–27. Photos by Norman Ng.

Exhuming the Climate of Indonesia: The Towuti Drilling Project

Satrio Wicaksono (S W) in conversation
with Anna-Sophie Springer (A S)
& Etienne Turpin (E T)

The diverse natural landscapes of central Indonesia inspired Alfred Russel Wallace to conceive of natural selection and biogeography theories, yet the region's long-term climatic and environmental histories are virtually unknown. From May to July 2015, the Towuti Drilling Project (TDP)—the first lake drilling project anywhere in Southeast Asia—conducted an international scientific expedition to drill into the sediment underneath Lake Towuti in South Sulawesi. The obtained drill cores will be used to reconstruct the climatic and environmental evolution of central Indonesia during the past 800 millennia through biogeochemical and physical analyses. Simultaneously, this research highlights the natural processes that helped generate the landscapes Wallace saw during his own expedition between 1854 and 1862. Anna-Sophie first met Satrio, then Project Coordinator of the TDP and a Ph.D. student at Brown University, during the 12th Northeastern Conference on Indonesia at Cornell University in the fall of 2014. After an ongoing email correspondence about the unique research, and a failed visit to Lake Towuti in June 2015, we had the chance to speak about his research on the occasion of *125,660 Specimens of Natural History*.

A S

Can you explain the origins of the Towuti Drilling Project? What began your research in this region of Sulawesi? Why is this area important? And what is the overall aim of the project?

S W

The Indonesian archipelago and the seas surrounding it are a major source of global water vapor and heat, and therefore play a crucial role in the global climate system. A better understanding of the convection and precipitation mechanisms around the archipelago over time will not only give us a better

idea of what Indonesia's precipitation will look like in the future but also give us deeper insight into the past, present, and future of the global climate system. Unfortunately, there are only limited climate data available from Indonesia. Based on our previous research, Lake Towuti, located at the heart of the Indonesian archipelago, contains hundreds of meters of sediment that can be used to reconstruct climatic and environmental changes during the last circa 800,000 years, the only known such record from the region. The Towuti Drilling Project is the first scientific continental drilling project in Southeast Asia, and from a paleoclimatic perspective, its location is just perfect.

My Ph.D. advisor at Brown, Dr. James Russell, first envisioned the TDP about a decade ago, when he started working in the Indonesian region. As an expert on both past tropical climates and lake ecosystems, he is interested in reconstructing and deciphering climate and environmental information contained within layers of mud buried underneath tropical lakes. Together with Prof. Satria Bijaksana from Institut Teknologi Bandung, James started some preliminary research at Towuti and surrounding lakes in 2007. After multiple fieldwork sessions and analyses of preliminary data, the two of them, along with their collaborators, began writing a proposal for the drilling project in 2012.

E T

You mentioned previously that you have done research in the region prior to this project—can you tell us more about how you prepared?

S W

We conducted seismic expeditions in 2007, 2010, and 2013, as well as a coring expedition in 2010. Seismic analyses are needed to scan the

sediment underneath the lake. The “air-gun” system, which produces seismic reflection data, is akin to ultrasounds often used with pregnant women. It allows us to detect the thickness of the mud that has accumulated on top of the lake's bedrock for almost one million years. Using these data, we were able to identify potential sites for coring/drilling.

The 2010 coring expedition gave us several piston cores from Lake Towuti. Each was about twelve meters long, and their base was dated to approximately 60,000 years ago. We have done various physical, biological, and chemical analyses on these cores, and our results suggest major environmental and climatic changes in the region during that period. These results confirmed our conviction that Lake Towuti is indeed a great site to study the climatic and environmental changes of Indonesia. Now, with our newly recovered cores from the TDP, we hope to capture and understand the major changes that might have occurred further back in time.

E T

In his day, all Alfred Russel Wallace needed was a letter from the Dutch in order to collect his specimens in Nusantara; over 150 years later, your legal requirements are much more substantial. Also, the setup for such a drilling project is extremely complicated. Can you give us a sense of the logistics involved in doing this kind of research?

S W

As the TDP is an international effort, up to twenty-five foreign researchers were involved in the actual drilling operation. We had to complete plenty of paperwork for various governmental institutions and at different levels of government.

We also brought in multiple containers and major drilling and research equipment from the U.S. and Germany. These containers and the drilling rig are quite big, and there were only a few vehicles and cranes that could be used to transport them to our dock once they arrived in Sulawesi. We had to coordinate with various shipping and transportation contractors to help with the movement of our equipment. Due to technical difficulties in the middle of our project, the project had to be extended by about two weeks, and we shipped in spare parts for our hydraulic pumps from the U.S. They were not easy to locate and eventually arrived safely in Sulawesi, but the journey was not without hiccups. Finally, the delay in our departure from Sulawesi caused us some problems, as it forced us to reschedule the demobilization of our equipment and rebook our return tickets. Neither task was easy given that our final departure date was so close to *Idul Fitri*, a major holiday in Indonesia.

AS

You are not the only scientist presently working at the Towuti Drilling site. Can you tell us about your team? What scientific fields are your colleagues working in, and what they are looking for? More specifically, what is it that you are hoping most to find?

SW

There are about thirty scientists working either at the site or the on-shore laboratory during the drilling project. The scientists, led by Dr. Russell and Prof. Bijaksana, come from five countries and have different scientific backgrounds. Some of us, like myself, are interested in climate questions. How has rainfall history evolved since the lake was formed? What caused rainfall patterns to vary? What was the environmental response to changes

in climate over time? We are using various proxy data extracted from the sediment cores to answer these questions.

A few scientists involved in TDP are interested in the geological processes that formed the lake. They want to determine the age of the lake, as well as the evolution of its physical form over time. For instance, we saw a sequence of soil, river sediment, peat, and lake sediment in some of our drilling sites, therefore allowing us to deduce the geological evolution of the lake, as well as how the water level might have varied over time. We also found several thick volcanic ash layers, which might have originated from volcanic eruptions in northern Sulawesi. If these layers can be tied to previously identified volcanic ash layers from the region, they can be used as time-horizon markers.

Lake Towuti also hosts many endemic species and is surrounded by one of the most diverse rainforests on Earth. The biologists among us are especially interested in finding microfossils from the sediment, which may help them understand the rates of biological evolution, as well as the sensitivity and resilience of Towuti's aquatic and rainforest ecosystems to climatic and environmental changes.

Finally, several biogeochemists are also involved in this project. Lake Towuti is among the world's largest iron-rich lakes. The ophiolite bedrock surrounding the lake supplies metals that drive important biogeochemical processes. Drill cores allow us to expand our understanding of these processes and closely study the impact of climate changes on environmental chemistry. By doing so, we hope to improve our knowledge on how to maintain a sustainable Towuti ecosystem in light of recent changes in climate and human land-use.



A S

Given the size of this project, and the remote area you are working in, it must attract a lot of attention. Are there any concerns by area residents about the project? What do the local communities think about your research?

S W

We have received a lot of attention not only from national and local media, but also from those living near the lake. The locals were particularly surprised to see huge cranes and other heavy equipment being transported through their villages to the project's dock, where the gear was assembled into a working drilling barge. The confused locals thought that this equipment was owned by PT Vale Indonesia, a nickel-mining company operating nearby, which has often had a contentious relationship with the locals. Unfortunately for us, the words "drilling" and "project" also carry with them negative connotations.

Within days after the project began, false rumors about our intentions started to spread widely. Some people that we met thought that we were going to do oil and gas exploration. Others were deeply concerned about the potential environmental impacts of the project; many asked us if a Lapindo-like mudflow disaster could happen because of our project.¹ The culmination was a demonstration staged by approximately 100 local residents and NGOs two weeks into the project. We listened to them, answered their questions, and worked hard to explain what the TDP really is.

We were quite surprised with the moves against our scientific project, as Dr. Russell and Prof. Bijaksana had already held a meeting with the sub-district head and local leaders two months prior to the start of the drilling. In addition, the district chief had known

about this project since 2012, when it was still in the planning stage, but the information did not trickle down to area residents. The fact that 2015 was a busy year in politics, with elections of the district chief and village leaders looming, also added another complex dimension.

We had already planned on doing outreach during our stay in Sulawesi, but the miscommunication with area residents forced us to go all out and work harder in conducting such activities. We held many meetings with various stakeholders: local leaders, government officials, local house of representative members, as well as representatives from NGOs. We also visited many elementary and high schools. In addition, we facilitated visits to our barge by government officials and locals alike, including school children, so that they may have a better understanding about our work. By the end, we were elated to learn that most locals had favorable views toward our project; many of them even expressed their open support.

E T

Regarding the drilling process itself, how long are the individual cores you are extracting from the lake bed? What condition do you extract them in (wet/dry, hard/soft, etc.)? And what will you do with this material next in order to study the samples collected?

S W

We hope to drill the sediment all the way down to the top of the bedrock. Lake Towuti's water depth is approximately 200 meters, and the sediment underlying the water and overlying the bedrock has a depth of about 180 meters. To perform the drilling, we have to connect a bunch of five-meter-long drilling rods or pipes. When the actual drilling or coring

equipment is lowered down through the inside of these rods, it brings along with it a three-meter section of plastic core liner. The drilled core sediment is captured in the core liner, and is prevented from falling back down by a core catcher when lifted up.

Once the liner is out on the drilling barge, scientists cut it into smaller pieces (maximum length: 1.5 meters), put end-caps on both ends of the liners, and label them. Visual inspection suggests that the drilled wet sediments inside the core liners consist of different facies (for example bodies of rock with specified characteristics representing a certain type of depositional environment), just as we had predicted before. We are able to see clay-dominated materials, sand-dominated materials, gravel-dominated layers, peat layers, as well as tephras (volcanic ash layers).

The labeled sediment cores are then brought to the shore during our shift change, which happens twice a day. The cores are logged for magnetic susceptibility and other physical characteristics using a logger that we brought from Brown University and then temporarily stored in our field laboratory. We also sieve the sediment left in the core catcher and analyze these tiny samples under a microscope. The cores are currently on their way to the U.S. National Lacustrine Core Repository in Minnesota, where the scientists involved in the project will split them open into two halves during the core-splitting and sampling party later this year. The working halves will be photographed and logged for various physical characteristics using more sophisticated equipment and finally sub-sampled to be analyzed further by different scientists in their respective laboratories. Meanwhile, the archived cores will stay untouched in the repository in Minnesota.

E T

In our correspondence and previous meetings, you mentioned that the core samples you collect from Lake Towuti will provide up to 800,000 years of climate history. Can you explain more specifically how this climate knowledge is extracted from the sample? What sciences are involved in such processes of paleoclimatology?

S W

Paleoclimatology is the study of changes in climate taken on the scale of the entire Earth's history. Humans started systematically collecting rainfall data from rain gauges and temperature data from thermometers only in the past few centuries. To obtain climate data from ancient times, we can use a variety of proxy methods borrowed from the Earth and Life Sciences that can tell us the amount of rainfall or temperature over a certain region during a certain period in the past.

The physical, biological, and chemical characteristics of Lake Towuti's sediment offer us clues of ancient climate history, which may help us understand the overall pattern of climate change and assist us in predicting how the climate might change in the future. For example, clay mineralogy may inform us of the types of materials that eroded easily and entered the lake, especially when the rainfall amount was high. During periods when the titanium level in Lake Towuti was higher than usual, for instance, we may deduce that those were relatively wet periods.

Using pollens extracted from the sediment, then observed and counted under the microscope, we can learn about the types of plants that were living in the lake's catchment area. Based on our pollen and leaf-wax carbon isotope analyses on the twelve-meter sediment cores from the 2010

CORE SCANS OF LAKE TOWUTI

by *James Russell*

Lake Towuti began to form about one million years ago, when movements of Asia, Australia, and the Philippines created fractures in the Earth's crust. Movement along these fractures allowed the region of Towuti to sink, creating the 200-meter-deep depression the lake occupies today. During its initial stages of formation, Lake Towuti was much smaller than today, and often-times existed not as a lake but a swamp, as depicted in the formation of peat, the sediment composed by remains of grasses, trees, and other plants. This contrasts dramatically with the green, banded clays that form in the deep lake today, where the sediment is composed of fine mineral material washed in from the soils and the remains of algae and other microorganisms that live in the lake. Indonesia has been an extremely active region geologically throughout the past million years, with frequent volcanic eruptions that spew ash into the atmosphere. Much of this ash falls onto Lake Towuti and is buried in its sediments. Although these eruptions are often very destructive, they release nutrients into the water, stimulating biological productivity by diatoms and other algae.

Reproduced here are four core scans we've produced at our labs since the expedition in 2015. In all, we drilled ten boreholes, which are anywhere from about 40 to 180 meters long, and cores from each hole are sectioned into 0.1-to-1.5-meter-long parts. This equates to over 1,200 core sections, each of which has a separate image, so this is just a very small subset of the images we have available. When viewed together, the core scans connote large changes over immense time-scales. Sediments vary from dark to light, red to green, and each of these colors is code for large environmental perturbations. In particular, large shifts between red sediments and green sediments record large changes in the lake level, driven by wet-dry cycles in regional climate that appear linked to the Earth's ice-age cycles. These lake-level shifts cause large changes within the lake ecosystem and surrounding landscape. Even within each individual core section, there can also be visually interesting features, including laminations that record short-term rainfall and drought cycles. Finally, if we move beyond the macro-scale scanned images, we have microscopic images of fossil pollen, fossil diatoms, minerals, and other materials from these cores, which tell us the composition of the sediments and can also be quite visually arresting.



→ Fig.02. Peat shows deposits from the early stages of the formation of Lake Towuti, when it was not a lake but a swamp. All scans courtesy of James Russell.

expedition, we know that savannah was the dominant ecosystem in the area surrounding the lake between 33,000 and 16,000 years ago, during the last ice age. This indicates that the climate was much drier at that time. We hope to obtain environmental and climatic information further back in time using the longer drill cores from the TDP. One of our goals is to test whether the climate in the region was also dry during previous ice ages, and if so, why.

AS

In their most cited paper on the Anthropocene, British scientists Simon Lewis and Mark Maslin emphasize the relationship between time and the Earth's states.³ How does it feel to think in such immense categories of time, nearly one million years into the past? Do you ever imagine the site of your research in that prehistoric state? What might it have looked like?

SW

In the grand scheme of geological time scales, the past 800,000 years is actually rather short. Scientists believe that the Earth was formed approximately 4.6 billion years ago. Earth scientists like me are used to touching and observing rocks and sediment samples that are millions of years old. To us, they are not merely relics of the past; they may also hold important scientific information about the present and the future, and as such are immensely valuable. For example, our study allows us to understand the natural variation of the environment and climate before humans began to populate the region.

The present-day lake must have undergone significant changes in terms of size and geochemistry due to geological and climatic changes. Based on our preliminary data from the field

we now know that lake levels have varied. Drilling at some of our sites yielded some non-lake sections, such as river and peat units. As mentioned, the landscapes around Towuti have not always been filled by lush rainforests. During dry and more seasonal periods, we might have seen savannah-type ecosystems instead. You may picture a vast expanse of grasslands dotted with some trees, similar to present-day Nusa Tenggara [Lesser Sunda Islands], during dry periods. At the same time, the lake level must have been lower, and the lake was smaller. It was a very different picture indeed.

ET

Do you expect that the team might find evidence in these samples for a contribution to the Anthropocene debate? According to the *Geologic Time Scale*, the Holocene Epoch begins in 11,650 BC, precisely the timescale you are investigating. Is there any possibility that you could find evidence of anthropogenic ecological change in your samples? Or, perhaps even a Global Stratotype Section & Point (GSSA) demarcation candidate for the Anthropocene?

SW

Given the slow natural sedimentation rate in the lake (averaging 0.02 cm/year), it is a little difficult to find evidence of anthropogenic ecological change in our samples. Archaeological and pollen-based evidence suggest that there was little disturbance by humans until the last century, when humans started to actively alter the landscape around the lake. I believe that the deforestation rate around Lake Towuti has increased significantly in the last decade. Not only has logging for timber become more intensive, but land clearance for pepper farming is also



increasingly widespread. Maybe in a few more decades the evidence of these activities will become clear in the sediment.

AS

You also mentioned the relationship of Lake Towuti and the Wallace Line when you told us that you were researching some specific “climate refugia” in the area. Can you tell us about these refugia in relation to Wallace’s research on evolution, speciation, and biogeography? It would also be interesting to learn more about the term “climate refugium” itself.

SW

In a paper that I published recently,² I concluded that elevation played an important role in determining the ecological manifestation of climate change in Indonesia. Based on two sets of climate and environmental proxy data from Lake Towuti and another lake located at a higher elevation (Lake Matano), there was a substantial difference in terms of rainfall and plant ecosystems surrounding the two lakes in the past. During the last ice age, when the climate in central Indonesia was generally drier and more seasonal, higher-elevation regions such as Lake Matano’s catchment were wetter and had a higher percentage of rainforest taxa compared to lower elevation regions.

Since those high-elevation regions served as a home for rainforests amidst grassland expansion due to the drying climate, we may call them “climate refugia.” When the climate became more favorable (i.e. wetter), the rainforests might have expanded, encroaching on lower-elevation regions at the expense of the grasslands. Given that there are multiple highlands in Sulawesi, as well as other

Indonesian islands, there might have been multiple “climate refugia” during dry periods.

Our data point to several cycles of drying and wetting in the past, implying that a series of rainforest expansion and contraction cycles might have occurred around the refugia. The expansion of rainforests from nearby highlands could have played an important role in the evolution of plants. Different refugial peaks might have contained distinct plant species as they underwent different climatic and biological histories. Thus, when expansion occurred during wetter periods, and different yet still-related species intermingled, new plant species might have been produced. We thus hypothesize that the presence of climate refugia in Sulawesi played a crucial role in maintaining the high biodiversity in the region.

AS

We imagine that in 800,000 years there have been quite significant changes in Sulawesi and the ancient lake you are studying. Yet, we wonder if the more recent changes to Indonesia’s rainforests, biodiversity, and land-use are even more extreme, but on a much shorter timescale. To change the direction of our thought for a moment, what does the future look like given the current land-use practices in Indonesia? In another 100,000 years, what might one find if the Towuti Drilling Project occurred again at the same site?

SW

If you look at the landscape around Lake Towuti now, you will see patches of barren, cleared land. It isn’t difficult to pinpoint what the culprit was. Almost every day, and peaking on the weekends, you see smoke coming from the



→ Fig. 04. Green clay shows darker-layered sediment when the lake level is high and the climate is wet.

hills bordering the lake. Farmers want to clear the land to cultivate pepper, currently a very profitable crop, so they ignite the fires, essentially destroying all the trees in certain parcels of land. There are also illegal loggers who fell the trees around the lake. The loggers are slightly more environmentally friendly than the pepper farmers since they only selectively take down the big trees. These two activities are certainly worrying, given the potential environmental impacts on the lake ecosystem. It is also saddening given that Lake Towuti is actually a conservation area under the jurisdiction of the Ministry of Environment and Forestry.

If one were to drill the lake sediment at the same site 100,000 years from now, one might encounter cores that have much higher sedimentation rates during the Anthropocene than the Holocene because of the increase in erosion. There is also a possibility that by then Lake Towuti will be much shallower than today. Chemical fertilizers that are used in pepper farming may also increase the amount of nitrates and phosphates, thus increasing the biomass of phytoplankton and algae. As a result, sediment cores extracted in the future may have a substantially higher percentage of organic matter than what we found in 2015. Finally, we would see plenty of trash that humans threw in or near the lake. Plastic bags, bottles, and other relatively non-degradable materials could be easily seen in future sediment cores.

- 1 The Lapindo mud-flow disaster (also known as Lusi) refers to the continuous eruption of a mud volcano in Porong, Sidoarjo in East Java. This, the biggest mud volcano in the world has submerged a dozen villages, displaced some 30,000 residents, and prompted the closure and route diversion of major highways since it started erupting in May 2006. There is an ongoing controversy surrounding its trigger. Several quarters contend that the disaster is human-made, started by the blowout of a natural gas well drilled by PT Lapindo Brantas in the area.
- 2 Satrio Wicaksono, James Russell, and Satria Bijaksana, "Compound-Specific Stable Isotope Records of Vegetation and Hydrologic Change in Central Sulawesi Since 53,000 yr BP," *Palaeogeography, Palaeoclimatology, Palaeoecology* 430 (2015): 47–56.
- 3 Simon Lewis and Mark Maslin, "Defining the Anthropocene," *Nature* 519, no. 12 (March 2015): 171–80.



Part 2: An Island Enclave Wedged Into the Woods

by Rachel Thompson

*She had no answers but thought the questions would suffice.
Cracking the cover of Shklovsky's Energy of Delusion, she at
last released a sigh of relief:*

*"Fyodorov used to say that the dead had to be resurrected;
mankind should set impossible tasks for itself, and after its
rebirth, mankind would exit earth as if from a waiting room,
and leisurely take over the cosmos."⁶*

I.

The origin story of Java's last dynasty goes something like this: Sénapati, first ruler of Mataram, was not yet king upon first encounter with his queen. While resting on a stone, the divine light fell upon him and he was carried to the southern shore. He sat in meditation, his effusion of metaphysical power causing a great disturbance in the sea. Presuming the day of judgment had arrived, Ratu Kidul—that watery queen whose daughter dwells at Dlepih—emerged from her lair, only to find a solitary man in contemplation on the beach. Having managed an invitation to her palace beneath the sea, Sénapati wooed the Spirit Queen with compliments to her skills of

interior design, her palace fashioned from fishermen's bones and bedecked with precious stones. They enjoyed an extended dialogue of mutual seduction, along with several rounds of empowering drinks. They fell in love and soon into bed. Sénapati spent three days underwater and was schooled in the knowledge of kingship, the secret authority of seen and unseen realms. Ratu Kidul brought great success to Sénapati at the Battle of Prambanan. She then agreed to become the consort of each subsequent ruler of Mataram, her palace now marking the southern anchor of the kingdom's cosmological order.

The arrival of the Dutch in Java, however, occasioned a veritable cut in this cosmos. In 1742 the kingdom of Mataram was summarily sacked by an army of rebel Chinese, trampled by the Madurese, and then handed over to the Dutch. Its disgraced king, Pakubuwana II, should have fled for the hills, disappearing without a trace. Instead, lamenting the collapse of his court at Kartasura, the sultan sent three of his courtiers—one Dutch and two Javanese—to search for a new royal site to the east. Ten kilometers down the road, along the banks of the Bengawan Solo River, lay the village of Solo, which Onggawongsa declared to be an auspicious site for the founding of a new court. Van Hohendorff, of a mind for dry feet, thought it too low and marshy. Nonetheless, the villagers of Solo were soon driven out and their dead exhumed, as construction of a new palace began. Distressed by the glory and upheaval that befell their home, they wept over the empty graves. On 20 February 1745, the entire contents of the former palace, sacred banyan trees and all, were marched but a short distance down the road, where a swift inversion of name—from Kartasura to Surakarta, *Axis-of-the-Cosmos*—heralded a contradictory new beginning and an odd refusal of defeat.

On his deathbed, not yet forty, Pakubuwana II, *Spike-of-the-World*, signed over sovereignty to the trade-zealous Dutch. In an act of self-abasement, he had himself buried at the entrance to a cemetery of little importance, where his body would be eternally stepped over. Apparently he couldn't lie still and was forever floating up from his grave. Some say he was later transferred to the royal burial grounds at Imogiri, just to the north of Ratu Kidul's lair. Eight generations thereafter, the last great Pakubuwana, number X, was known to converse with various animals in their respective languages—a classic kingly gift. Particularly fond of small birds, he held formal funerals for them, complete with little caskets. Most known for his prophecies, his divinations pointed to the very end of the world that once revolved around the court of Surakarta.⁷

*When it proved impossible to reach the edge of the universe
within a single sleepless night,
she turned her attention to the discrete actions of men,
in search of an alchemical approach to the writing of time.*

II.

After a prolonged period of hermetic reclusion, burrowing deeply down various holes, I set out for the bend along the Bengawan Solo where Dubois's conscripted workers had doggedly dug. I'm unsure of what I was after, but there was an itch that called for a scratch. In 1894, after the digging wound down, Dubois sent home some 400 crates, bearing in excess of 40,000 individual items of osseous matter. Before they were dispatched to the metropole, the fossilized remains were



arrayed across the floor of the Dubois abode in Tulung Agung, laid thick as a carpet, crowding out the domestic sphere. Of all the photographs taken by Dubois, this one proved stubbornly resistant to removal from my mind. Something about those relics of the colonial sitting room, edged into the background—eclipsed by a swelling proliferation of atavistic bones. While his unpaid diggers toiled under the equatorial sun, Dubois sequestered himself under the canopy of his villa's veranda, sorting through his calcious spoils. Karl Martin, director of the new Geological Museum in Leiden, implored Dubois to send him the specimens for safekeeping, scolding him gently for leaving them sprawled across the threshold. Dubois at first demurred. One day, without warning, the crates arrived at Martin's door. With no storage at the museum yet secured, a house was quickly rented. When the owner feared the floors would give way under the formidable bulk of Dubois's haul, the collection began its peripatetic progress "round the city of Leiden, stopping at Breestraat 22, the coach-house at the Doelensteeg, and the psychiatry building of the university hospital."⁸

Dubois soon followed suit, intending to write up his findings in the form of a book, with Brill to publish the results. He first thought the project might be completed within the year, a drastic underestimation of the task at hand. Fifteen years on, in a letter to Brill, Dubois writes that "although this year I have done the impossible to finish a first and most important part of my publication, [...] I [have] not been allowed to succeed."⁹ Myriad snags befell the book, not least of which was Dubois's irascible, quarrelsome, and paranoid disposition. Although Martin vacated a room in the museum within which Dubois was to work, it seems the ostensible author only

rarely stopped by. A former student said of Dubois that the professor "had the habit of just lifting a corner of the veil of a scientific concept, but he was loath to settle down and work it out thoroughly; he preferred to leave to others with more perseverance the task of continuing and finishing it."¹⁰

Over the years, an endless trail of letters was exchanged in reference to the nonexistent book, which stubbornly refused to materialize. Fearing financial disaster and eager to dampen rumors surrounding the ill-fated tome, Frans de Stoppelaar, director of Brill, begged the doctor to send the "missing link" of his monograph, "for though art mortal and who will finish it after you're gone?"¹¹ Shortly thereafter de Stoppelaar himself passed away, following surgery to the stomach from which he failed to recover. Years later, after serving as Dubois's assistant, cataloging the near entirety of the massive fossil collection, Father Sanctes Bernsen succumbed to acute internal bleeding of the stomach. Although it could never be substantiated, some attributed the Father's gastrointestinal disorder to the stress incurred from working for such a disagreeable man.¹²

In the initial pamphlet announcing his *Pithecanthropus* discovery, Dubois wrote that the creatures found at Trinil likely perished in volcanic cataclysms, their corpses carried by the current of a large Pliocene river. Before being deposited in the mud, the bones must have separated through the rotting of flesh, torn one from the other and dragged away in a crocodile maw. Many of these aquatic predators were found interred in the strata, while traces of their teeth marked the spongy region of many a bone.¹³ Of the diverse endeavors that took precedence over the book, photography and the pursuit of ultimate optical accuracy loomed large. Dubois's desire for representational precision was continually frustrated by the elusive truth

early photography seemed to proffer. Despite constant experiment, the math of optics refused to yield to his endless effort to eliminate distortions of scale. Tweaking parameters of lighting, positioning, and quality of lens would not suffice. Slippery partial truths simply would not do. Dubois was ultimately driven to fashion his own terribly elongated camera, stretching three feet in length from negative to lens. Only then would a centimeter at the edge comply with one dead center in the frame.

*Following Blavatsky, humans descend from spirit, not animal.
In her elaborate evolutionary history of the cosmos, the first men
were born with neither brain nor bones.
Ethereal and hermaphroditic, they await materialization.*

III.

Dubois's skullcap, femur, and molar now reside in a bullet-proof case, within the public galleries of Naturalis, surrounded by a menagerie of taxidermy creatures. Facing skepticism towards his claims, Dubois withdrew his fossils from the limelight and locked them in a safe for perhaps twenty years. I'm unsure at what point he began collecting his own fallen canines, incisors, and molars, but there's a tin on a shelf in Leiden filled with green pill boxes, each containing one of the professor's teeth. Before his retreat to his boyhood home of rural Limburg, Dubois constructed a life-size plaster rendition of the *Pithecanthropus erectus*, using his eleven-year-old son Jean as a model—a curious choice given that he once wrote that the bones likely belonged to a very aged female. In

1900, Dubois brought his statue to the Paris Exhibition, where it acquired the nickname *Pietje*—Little Peter. The episode was curiously depicted, some years later, in the Mexican comic book *Illustrious Lives*. Pietje now stands at the end of a row of acid-free boxes, back up against the wall under an overhead pipe, within the storage facility of the Dubois Collection at Naturalis. In contrast to his voracious Sangiran brethren, Little Peter's mien is altogether melancholy, leaning toward the pensive. Gazing downward at a deer horn clasped in his hand, it seems he can't quite countenance how he came to possess such an implement and what, pray tell, he ought to do with it. His surface is quite shiny and seemingly shellacked.

Were it not for the contrived nature of his innards, he would have been a prime candidate for Jeremy Bentham's ranks of posthumous sentinels, standing ever inert yet alert for perpetuity's slow march. Now sitting with statuary stillness in a hallway at the University College London, Bentham bequeathed his body to the living for the purpose of dissection, in keeping with his doctrine of utility. Thereafter, his remains were to perform a commemorative role. He left detailed directions under the heading *Auto-Icon*: "The skeleton will be brought together in such a manner, that the whole figure may be seated in a chair usually occupied by me when living, in the attitude in which I am sitting when engaged in thought in the course of writing. The skeleton will be clad in one of the suits of black occasionally worn by me. The whole apparatus will be contained within a mahogany box, and if it should so happen that my friends and other disciples should be disposed to meet to commemorate the founder of the greatest happiness system of morals and legislation, my executor should cause to be conveyed to the room in which they meet the said box with the

contents therein.”¹⁴ The philosopher foresaw nothing exclusive in this process and envisioned whole temples of fame and infamy in which every man would serve as his own statue. He saw tree-lined avenues interspersed with Auto-Icons, weather-proofed with varnish and gum, and even a historical theater with tableaux vivant in which the characters would represent themselves. Is not identity preferable to similitude, Bentham asked, believing Auto-Icons would ultimately supersede the necessity of sculpture.

Do not feed yourselves with illusion.

*You cannot be everywhere: you cannot do everything.*¹⁵

During the time when Dubois was to be working on his manuscript, he found all manner of endeavor with which to occupy his curious mind. He studied climates of the geological past, researched the genesis of Holland’s coastline, queried the origins of Dutch peat bogs, and published on the extraction of drinking water from coastal dunes. In 1906, he purchased a marshy estate in Limburg, by the name De Bedelaer, which he intended to transform into a nature park. This retreat to rural Limburg fuelled wild legends to explain his flight into oblivion. If he couldn’t put man back in nature, perhaps he’d fashion his own cocoon. The church reproached him from the pulpit, and he believed the Catholics were out to destroy his bones. Rumor even spread that Dubois, one day, had shattered his own fossils.

At De Bedelaer, Dubois turned his attention to the issue of cephalization, intent to discover the biological laws governing the relationship of brain to body size. He also devoted great energy to the conversion of his estate to its primordial form.



His ultimate goal: to build a monument to the past through the recreation of a landscape in which early man lived in close harmony with his environment. But his time was out of joint. He altered the water level of the bog by three meters and dug up fossilized seeds from the mud—among them, those of the mammoth tree. The fossil record revealed a warmer past, during which clay was deposited by numerous rivers. Dubois sent for certain plant and animal species, which were still alive in China and the Americas. The incidental death of thousands of fish was no mind if he could plant a swamp cyprus that would have stood in their stead ages ago. Perhaps he fancied he could invert the flow of time, conjuring an idyll from eons past. Perhaps the present became an impossibility—the only answer: to craft a land-locked island home, wedged into the woods.

De Bedelaer had in recent years turned into a hotel and conference center—a bit out of the way—and was not currently open for business, though at the front door, a still life had been arranged on a chair. After knocking several times, two cats appeared at the windowsill, yet no humans were on hand, save for the image of Queen Beatrix waving adieu, plastered in the rear windshield of an ancient camper van. Wandering the woods, I found the former fens, their waters now much diminished, and a pair of bat roosts Dubois had built following the plans of Charles Campbell of San Antonio, Texas. In the Dutch dialect *de Bedelaer* means “the beggar.” Legend has it that after a knight refused scraps to a vagrant, his castle was swallowed up by the earth.

In December 1940, Dubois died on his estate, seven months after Hitler invaded the Netherlands, and in the same year that street musician Gesang Martohartono composed an ode to that most auspicious river, the Bengawan Solo:





Dubois's demise fell one year after that of Pakubuwana X, the zoologist and bird-burier who remarkably passed on the first of the Javanese New Year, the most powerfully endowed moment cosmologically conceivable, and on the same date—by the Roman calendar—as the abandonment of the sacked court of Kartasura. Years later, he would be remembered as predicting the arrival of the Japanese, the dropping of the first atomic bomb, and the date of Indonesia's declaration of independence.¹⁶

*I swear to you, that a man by the name of Johan,
after a terrible dream of the coming flood,
has built not one but two life-size versions of Noah's storied ark.
It houses live squirrels, horses, and kangaroos, while more
sizeable creatures have been rendered in polyester.*

The history of our planet has seen five mass extinctions since the origin of complex forms of life: the Ordovician, Devonian, Permian, Triassic, and Cretaceous periods. We are now midway through extinction number six.

- 6 Viktor Shklovsky, *Energy of Delusion* (Champaign: Dalkey Archive Press, 2007), 1–2.
- 7 John Pemberton, *On the Subject of "Java"* (Ithaca: Cornell University Press, 1994), 122.
- 8 Paulinus Cornelis Hendricus Albers and John De Vos, *Through Eugène Dubois' Eyes* (Leiden: Brill, 2010), 125.
- 9 *Ibid.*, 47.
- 10 Bert Theunissen, *Eugène Dubois and the Ape-Man from Java* (Dordrecht: Kluwer, 1989), 28.
- 11 Albers and De Vos, *Through Eugène Dubois' Eyes*, 100–1.
- 12 *Ibid.*, 125.
- 13 Eugène Dubois, "On *Pithecanthropus Erectus*: A Transitional Form between Man and the Apes," *The Journal of the Anthropological Institute of Great Britain and Ireland* 25 (1896): 243.
- 14 Jeremy Bentham, "Will codicil, Auto-Icon," UCL Special Collections, Bentham IX/123–124.
- 15 *Ibid.*, "Emancipate Your Colonies!" address to the National Conference of France, 1793.
- 16 Pemberton, *On the Subject of "Java,"* 124.

Fig. 05. (page 123–24) Veranda of Dubois's home in Trinil, East Java, played with the remains unearthed from the Begawan Solo. Figs. 05–07 are courtesy of the Dubois Collection at Naturalis, a research center for biodiversity and museum of natural history in Leiden.

Fig. 06. (page 131) Panel from the Dubois volume of the Mexican comic book series *Vidas Ilustres*.
Fig. 07. (page 133) The plaster model of *Pithecanthropus erectus*, modeled after Dubois's son Jean.
Fig. 08. (page 134) Opening bars of the song *Begawan Solo*, composed by Gesang Martohartono in 1940.

Fred
Langford
Edwards:
Re-Collecting
Wallace's
Specimens
(2007–15)

Today, only two specimens from the enormous collection Alfred Russel Wallace gathered during his Malay expedition between 1854 and 1862 are held by Southeast Asian museums: a Flycatcher bird at the Singapore Natural History Museum, and a Longhorn beetle at the Kuching Natural History Museum, Sarawak, Malaysia. Each of the other 125,660 specimens he collected in Nusantara is held by natural history collections in the United Kingdom, the Netherlands, Germany, or the United States. But even among these museums, the “Wallace collection” is not easily located. While it might be of interest to historians of science who originally collected a specimen, in natural history museums nearly all materials are ordered by the logic of taxonomy. Still, as long as the original labels remain attached to their objects it is possible—although extremely painstaking work—to identify their historical collectors.

While collaborating with Dr. George Beccaloni at the London Natural History Museum, the British photographer Fred Langford Edwards dedicated several years of his career to locating and documenting original Wallace specimens in British zoological collections, including the Natural History Museum at London and Tring; the University Museum of Zoology, Cambridge; the Liverpool World Museum, and the Linnean Society London, which holds Wallace's original notebooks. Edwards's practice involves a sustained and multilayered consideration of the discourses of scientific knowledge. His work includes field research and the investigation of collections of artifacts accumulated in the name of particular branches of science, medicine, anthropology, and culture at large. In meticulous sessions, Edwards photographed hundreds of Wallace specimens with his medium-format equipment, allowing for the images to be enlarged (for exhibitions) far beyond the original dimensions of the objects. By removing each specimen—including a beetle and the skin of an orangutan obtained by Wallace in Sarawak—from the archives, and photographing them as unique objects, Edwards emphasizes the specimens' singularity, which become especially visible in these high-resolution images, thereby encouraging viewers to scrutinize the morphologies of these species, as was done by so many nineteenth-century naturalists.

All photos courtesy of the artist and the Linnean Society of London; the Liverpool World Museum; the National Museum of Wales, Cardiff; the Natural History Museum at London and Tring; the University Museum of Zoology, Cambridge, respectively.







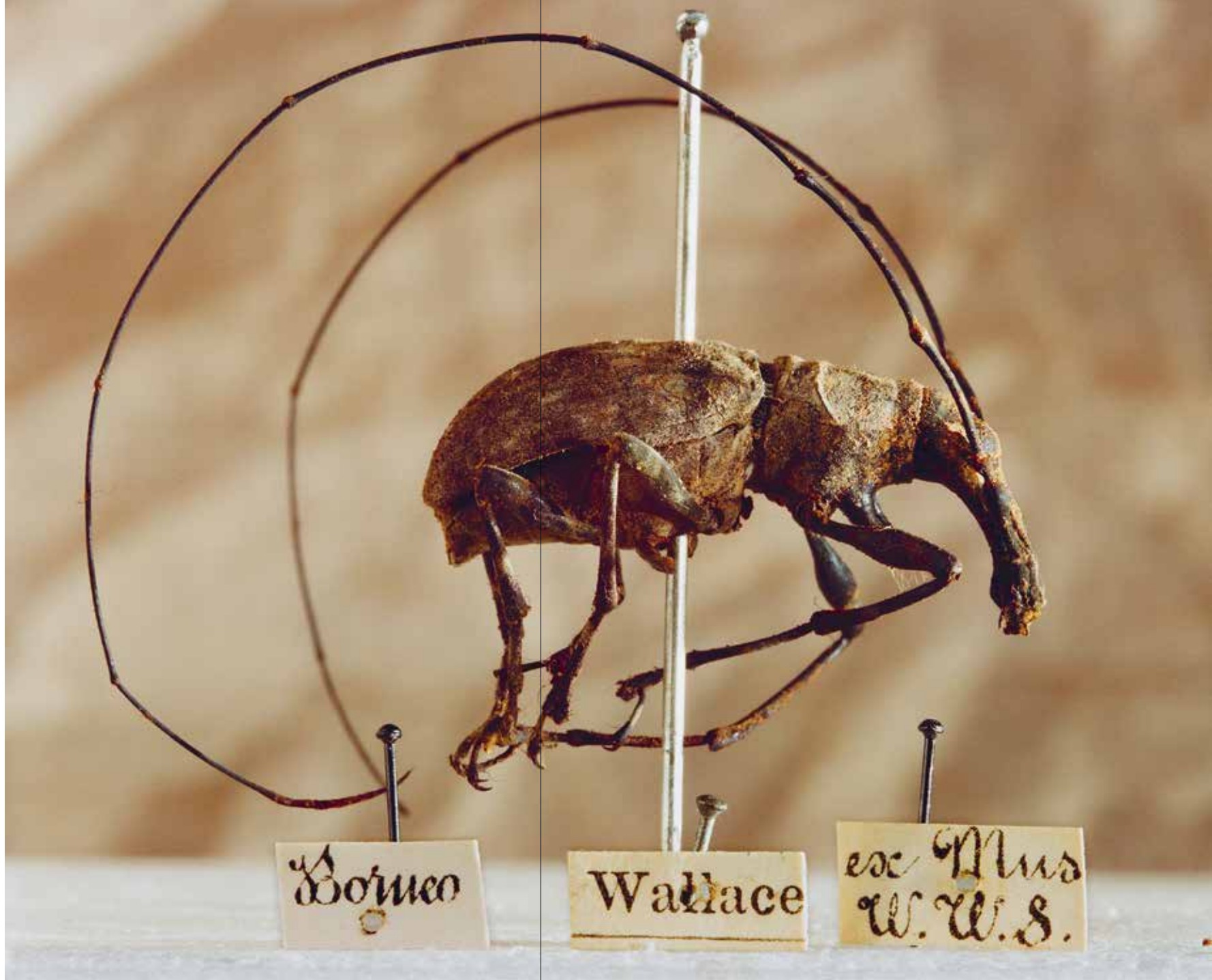
432 BB

Bucerus ruficollis

Skull

There are two specimens with
this number in the catalogue the
other being a skeleton of B. rhinoceros
This skull does not belong to that skeleton

Bucerus



Borneo

Wallace

ex Mus
W.W.S.





MUSE. ZOOL. CAMBRIDGE
FIG. PARADISAEIDAE
Paradisaea apoda
apoda
CAT. NO.

Paradisaea apoda
(Linn.)
Great Bina of Paradise
A.S. Dallas

Intercolonial Technogalactic

by Geraldine Juárez

I.

<https://www.google.com/culturalinstitute/beta>. I typed the term “cultural treasure” in the search box. The result: 164 matches. Then I made a new search but typed nothing. As of today there are 5,020,205 items at Google Arts & Culture (formerly the Google Cultural Institute) plus links to exhibitions, museum views, and “user galleries.” One hundred and sixty-four of those items (0.000032 percent) are related to Indonesia. There are also ninety-six exhibits and forty-one user galleries related to the search term “Indonesia.” There is also one collection entitled Museum Nasional di Indonesia, with about 101 items.

To organize you must first collect. The colonial impulse is a combination of economic and scientific desire. While the British explorer and collector Alfred Russel Wallace (1823–1913) projected this impulse into the future, the Google Cultural Institute directs its ambition into the past; both use conservationist ideas to accumulate information and profit, yet animals and data produce different kinds of specimens.

Organizing information is never innocent.

II.

In their promotional video, the Google Cultural Institute define their content platform as a place where one can “Explore art projects, historic moments and world wonders, to experience the art and ideas that shaped our world right from your own home.”¹ Which ideas have shaped our world? Yours? What about mine? Colonialism is one. I am a by-product of

colonization. I was born in America, the continent where the modern colonization race was unleashed. I come from a country colonized by Spain: México. I am also a mestizo woman—a category created by coloniality—and recently, to make it even more complex, I became an European citizen. Colonization is a complex concept because it involves many kinds of exploitation, and conflicts past and present have derived from it. Colonization also involves knowledge, trade, and a hell of a lot of violence and archives. There is also another idea that has shaped my world, and yours too: the Internet, the archive of archives. I typed “internet” into the search box of the Google Cultural Institute and retrieved 268 items. These include a copy of a speech written by Eric Schmidt, the executive chairman of Google, and fifty-eight exhibits ranging from “Art Post-Internet” and “The Origins of Internet in Europe,” dedicated to author and entrepreneur Paul Otlet’s Mundaneum. There is another idea that has shaped “our world,” and how we scroll through the Internet: Google. I clicked the “About” link in the Google Cultural Institute only to find out that, since I last accessed it some months ago, this website was recently rebranded as “Google Arts & Culture (GAC),” a component of the GCI at large. I notice a tweak in the slogan: “Explore collections from around the world with Google Arts & Culture created by The Google Cultural Institute.” There is a video about another component of the GCI, “The Lab,” where a team of engineers and artists work in their offices in Paris at the “crossroads of ideas, art and technology.” The section dedicated to cultural institutions attempts to explain their intentions, digitalization services, and potential in the capture of new audiences. A brief timeline offers a condensed description of the evolution of this not-for-profit enterprise, but there is a crucial bit of history left out from the vast stores of knowledge that the Google Cultural Institute offers to the world: its origins.

In a press release from 2011, the Head of the Google Art Project, Amit Sood, states that the Google Cultural Institute “started as a ‘20 percent project’ by a group of *Googlers* passionate about making art more accessible online. Together with our museum partners around the world we have created what we hope will be a fascinating resource for art-lovers, students and casual museum goers alike—inspiring them to one day visit the real thing.”²

“Powered By Google: Widening Access and Tightening Corporate Control,” by Dan Schiller and Shinjoun Yeo, was one of the first texts to historicize the missing bits of history behind the colonial impulse that set the stage for the inauguration of the GCI’s headquarters in Paris in December 2011, which has its origins in a visit of Eric Schmidt to Iraq.³ The authors point to the following paragraph excerpt from the 24 November 2009 *Wall Street Journal*, to situate the first expression of interest in the realm of cultural heritage by Google:

“Google’s chief executive Eric Schmidt said during a trip to Baghdad this week that Iraq’s stabilization could lead to business opportunities in the country.

“The creation of a new Iraqi state ultimately means business opportunities for global firms.”

The search giant said Tuesday that it will post thousands of photos from the National Museum of Iraq early next year. The Baghdad institution has an extensive collection of Mesopotamian art but has frequently been closed because of security concerns.

According to Reuters, Google staffers have taken more than 14,000 pictures of the works, and Mr. Schmidt said at a news conference that ‘I can think of no better use of our time and our resources than to make the images

and ideas from your civilization, from the very beginning of time, available to a billion people worldwide.”⁴

As much as the Enlightenment was about equality and the power of reason—and has helped us and others before us to enact critiques of colonialism, slavery, and oppression—it was also behind the idea of “civilizing barbarians” *for their own benefit*. There is nothing rare about empires invading and destroying weaker countries, but the way colonization was presented as a civilizing endeavor was unique—and probably couldn’t have happened without the Enlightenment and the archivist impulses that emerged from it.

Colonization without archives is a purely military affair, a barbaric enterprise. How would Google look without a Cultural Institute whose mission is helping to “preserve and promote culture online to make it accessible to the world”? It merely would be pure accumulation and profit. The Capitalocene, as articulated by Donna Haraway, following Jason Moore, is a term that describes the spirit of accumulation on a planetary scale, or “profit above all else” and “the logical extension of the surplus value accumulated through colonialism and slavery.”⁵

Long before Google started archiving *the world’s information*, Derrida diagnosed the spectral messianicity,⁶ *the fever* behind the idea of the archive: “Nothing is more troubling that the archive,” he wrote.⁷ Archive fever is operative in Google’s new cultural endeavour, but on a completely new scale, which is “nothing short of planetary, but its reach is not merely physical or geographic. The company’s collecting impulse, likewise, evinces a breath-taking cultural and ideological range.”⁸

What is this ideology?

III.

In Google Arts & Culture, I can explore Historical Events through “incredible stories behind many significant moments in history.” The search box is a blank field through which I explore the “content from over 1000 leading museums and partners who have partnered with the Google Cultural Institute” according to the footer of this page. I search therefore I scroll. I can only explore so much; the right-click option is disabled, so I cannot save the images to my hard disk. There is no API to go beyond these thumbnails to the source. I am a peasant user with limited access. The representation of access is a box where you can search. But exploring is not searching; if I decide not to use the search box some content options are always available in their homepage: “Your Daily Digest,” “Stories of the Day,” “Featured Content,” “Virtual Tours,” “Featured Content,” or just “ZOOM IN” or “Explore by time and color.” I can scroll and click around the GAC without searching for anything. Exploring without direction. Enjoy culture anytime, anywhere.

“Today’s undead Internet has a universal interface based on only two functions: the search and the feed. [...] The search is there for you when you already know what you’re looking for. When you don’t know, you can always get fed by your feed, the singular and personalized home feed, whose function is to homogenize time, synchronizing our attention at one singular speed.”⁹

The encyclopedic vision of Google is far from visionary. The use of knowledge for profit is the same kind of business Wallace was in. To explore, discover, collect, and profit from privileged access to certain kinds of information was the motivation for all previous colonial collections. Google, like Wallace, is what Anna-Sophie Springer describes as a “professional measurer,”¹⁰ but the scale of the commercial interests between the two are significantly different: Google

is a for-profit corporation of planetary proportions, in constant need of data and standardization to make more efficient what it captures and organizes. Digitization and turning everything into information is a patch for organizing society in a cheap and scalable way: convert all things into data and manage them easily.

Both the search box and the feed are standard features of the web, tailored to appeal to our contemporary information anxieties. The search is the bait and the feed is the switch; both services are free and feed each other, together with us, in an endless loop of corporate feedback. Indeed, the “private and public spheres get entangled in a blurred zone of hyperproduction.”¹¹

The search box is more or less about activity while the feed is about passivity, and it only makes sense that the Google

Cultural Institute has developed products under the logic of these two states to interface their company with museums. Take, for instance, the Google Cardboard product, a viewer for smartphones that allows users to “experience virtual-reality in a simple, fun and affordable way.”¹² The viewer case is made of cardboard and can be bought or built by yourself. The Palace of Versailles currently offers tours for exploring the castle using Google Cardboard: “Suddenly, exploring the Palace of Versailles [is] as easy as opening an app.”¹³ In order to explore museums in virtual reality, it is necessary to download an app from the Google Store. The mobile phone is thus the bridge between the passive and the active state of content provided by museums via the Google Cultural Institute. It is also the link between the private and the public.

Both the active and passive states of content generate more data than can be processed to fine-tune tastes, target advertising, and augment the capabilities of the algorithms at the core of Google. Even more interesting is that it is the passive state that most profits from public—albeit institutional and managed—culture.

When artistic expression is turned into mere content, images become mere *assets* that can feed any application. *Android Wear* offers the possibility of installing different artworks as faces for digital wristwatches. Also, through a browser plug-in, it is possible to:

“Breathe a little culture into your day! Discover a beautiful artwork from the Google Art Project each time you open a new tab in Chrome.”¹⁴ Perhaps the most passive form of the content collected from Google’s partner museums, and the one that reveals most clearly the for-profit agenda behind the GCI, is the *Chromecast Backdrop*, a thumb-sized media streaming device for displaying “Everything your love, now in your TV.”¹⁵

For thirty-five dollars, it is possible to plug the Backdrop device into an HDTV, connect and “cast apps from your phone to your TV.” When our relation to networked information is completely passive, we start *casting*. Again, you need the Chrome extension for the browser, or an app for the phone. A promotional video for Backdrop shows Google’s product manager, Duncan Osborne, explaining that when a user is not casting content to the TV, “it runs passive content, so it becomes a beautiful background for content, including artwork. With Backdrop, Chromecast users can explore and learn more from works by iconic artists like Monet, Van Gogh and Degas right in their living room. Our goal at the Cultural Institute is to expose as many people to as much cultural content as possible, which is right in line with Google Cultural Institute’s mission of democratizing access to the world’s culture.”¹⁶

Chrome®, *Android*®, and *Backdrop*®.

IV.

I am tired of scrolling. And clicking in the box for more information. I can zoom into some images. I keep scrolling. At Google Arts & Culture, my body collapses in my fingers. I am scrolling the Museum Nasional di Indonesia right from my own

home. Scroll. I keep looking at these images, comparing them, and there is no sense of hierarchy among the images, only between the collection, museums, their brands, and their representations. Both the images representing the collections and their “Details” are trapped in the very distinctive CSS white and clean vertical style that currently dominates the web. Click. I am strolling a visual database. Where is the server storing this database? Where is the data-center storing this server? My body collapses in my fingers, the museum collapses in a server somewhere. The sense of hierarchy that my body follows when I stroll through a museum: still here. The interface defines how my fingers should stroll the information in this collection. A database.

The interface replaces the conflict behind the construction of the collections and the violence of taxonomy. The interface is the opposite of complexity; its goal is to make the exploration of information convenient. An interface will always fail at communicating the context of the information it displays—in other words, its history. Interface simplicity as a new type of colonial monumentality. What’s behind the interface is the database.

Is the museum a database?¹⁷ No. Is Google Arts & Culture a database? Yes. The impulse driving the database is that of the archive. The database does not replace the archive or the collection; it merely evokes it, to paraphrase art theorist André Malraux. In the seventeenth and eighteenth centuries, knowledge was centered around the *table*.¹⁸ The database—full of tables—is still the center, and like the archive “is very much a human problem, not a system problem.”¹⁹ Mike Pepi elaborates how the neoliberalization of information of public culture is transforming the museum as an institution: “Though we often use the term ‘memory’ to measure the storage capacity of a database, this is

far from the same type of memory that the museum constructs and preserves. It is not passive data collected and stored by virtue of its a priori importance but instead material that achieves utility only through its potential to unequivocally deliver a command to an actor with a specific intent, an intent to which the database delivers unmatched efficiency and competitive advantage.”²⁰

A clear example of this cultural appropriation as economic opportunity is Europeana,²¹ a “knowledge-sharing platform” funded by the European Union that offers images, texts, sounds, and videos about European cultural heritage, with the mission of “bringing Europe’s vast wealth of cultural heritage to the world. The Europeana Foundation exists to promote this digital cultural heritage, and to unlock it for future generations. For change. For ideas. For progress.” Its language and function is very similar to those at GAC, where digital collections are *data*, and museums are called *partners*. However, the difference is that through Europeana, users that find something they like can “download it, print it, use it, save it, share it, play with it, love it!” Plus, there is “no

need to travel the continent, either physically or virtually!”

Europeana Labs²² is a section on the platform that welcomes the user with: “This is your code, this is your heritage, these are your labs,” and the first project featured under the “Inspiration” section is a pilot project developed with “Google’s Niantic Labs and three partner memory institutions—the Swedish National Heritage Board, the National Heritage Board of Estonia, and the National Heritage Board of Poland.” Also, Google’s Field Trip[®] tracks the location of the user to offer a feed of content about the surroundings, ranging from art and historical landmarks to shopping and lifestyle options. The Europeana website highlights the economic advantages that data offer “to enable and promote the creative re-use of cultural content in the tourism sector,”²³ and how they have managed to identify “potential project content partners, worked closely with them on the curation and enrichment of their collections and facilitated the data integration in Google’s Field Trip by supplying an Europeana API-enabled content feed,” in order to offer to providers extensive branding by including their logo and “a short profile and links to their website.”²⁴

I am not saying that there was a pure art history free of profit before this type of database embodied in the GAC website. Institutional culture is part of a specific way of “seeing art,” and museums have always organized information in an imperial way. In Wallace’s period, objects brought to Europe from the colonies were used to create museums filled with what colonizers considered “cultural treasures” and “heritage.” Google is merely the techno-colonial version of this same spirit, offering “tools” to preserve and make accessible their particular version of art and history, organized in their own

way through their own agenda for their own purposes, which happen to include economic benefits for their “partners.”

Google Arts & Culture and related products that act like tour guides (such as the Field Trip app²⁵ and the features of their cultural platform more generally) are based on the visual capabilities of the user—it’s about viewing images. But a virtual tour is the opposite of situated knowledge, as the database “represents while avoiding representation.”²⁶ Even if Europeana uses the collections provided by publically funded institutions to feed the Google database with the goal of promoting places and boosting digital tourism, and Google’s Art Camera strolls museums to copy their structure digitally and create three-dimensional representations so users can take a *virtual tour, any day, any time*, let’s not forget that “stuff that can be copied tends to become superabundant, which means that it is only valuable by virtue of its interconnection to stuff that *cannot* be copied, like space and time.”²⁷

Viewing the screen, scrolling the page, comparing images, and casting content is a specific way of *accessing the world’s culture* that, in the words of feminist artist and researcher Femke Snelting, “ignores the destabilizing and critical potential of culture, let alone invests in a platform for people to think their place in the world.”²⁸ For Snelting, both the Google Cultural Institute and its GAC platform have nothing to do with what we should expect from culture, nor what we should demand from an institution, since “from the perspective of Google, culture is just another type of information to be accessed, whereby access means allowing people to call up an image in a slick interface, hopefully with an infantile description attached.”²⁹

For the official launch of the Google Cultural Institute in 2011, the American company had digitized the collections of

seventeen art museums, including the Alte Nationalgalerie (Berlin), The Freer Gallery of Art (Washington D.C.), The Frick Collection (New York City), Gemäldegalerie (Berlin), The Metropolitan Museum of Art (New York City), MoMA (New York City), Museo Reina Sofia (Madrid), Museo Thyssen-Bornemisza (Madrid), Museum Kampa (Prague), the National Gallery (London), Palace de Versailles (Versailles), Rijksmuseum (Amsterdam), Smithsonian Institution (Washington, D.C.), The State Hermitage Museum (St. Petersburg), State Tretyakov Gallery (Moscow), Tate (London), Uffizi (Florence), and Van Gogh Museum (Amsterdam).³⁰

Although the collections digitized by the Google Cultural Institute have grown and diversified since then, the collections of Western institutions and Euro-American museums are disproportionately represented in relation to the Global South. This could perhaps be seen as an interesting movement

inwards, an introspective look that accidentally highlights the cultural legacy of colonialism.

It is important to emphasize that digitization doesn’t take away the physical elements of a certain culture. It just makes a copies of it, which can be reframed independently from the way the originals are interpreted in specific collections to hopefully create new readings and understandings, or as with Google Cultural Institute, use these copies to strengthen the cultural authority sought by certain institutions. As an example, let’s take The British Museum, the colonial museum par excellence, which is described in the press release of their partnership as “the collection of every citizen of the world” and “the most comprehensive survey in existence of the material culture of humanity.”³¹

What happens when The British Museum is digitized by Google?

V.

There is an app of the Mundaneum in the Google App store, as well as an exhibition in Google Arts & Culture. I scroll around.

“Brussels, Belgium, Europe, 1895: two men shared a dream of ‘indexing and classifying the world’s information.’ Paul Otlet and Henri La Fontaine’s work foreshadowed the network of knowledge that a century later became the Internet with its search engines! Otlet and La Fontaine aimed to preserve peace by assembling knowledge and making it accessible to the entire world. They built an international documentation center called Mundaneum. They invented the modern library Universal Decimal Classification system. La Fontaine won the Nobel Peace Prize in 1913. By 1935, their

Mundaneum grew to a staggering 16 million cards covering subjects ranging from the history of hunting dogs to finance! The Second World War and the death of both founders slowed down the project. Although many Mundaneum archives were stored away, some even in the Brussels subway, volunteers kept the dream alive. The French community government of Belgium brought most of the archives to a beautiful Art Deco building in the heart of Mons near Brussels.”³²

There are some accompanying pictures.

The relation between Paul Otlet, the Mundaneum, the city of Mons, and Google was non-existent until the arrival of a data center in the city of Saint Ghislain, right next to the current Mundaneum archive center. Elio di Rupo, former prime minister of Belgium and chairman of the Socialist party, was in charge of the relocation of the Otlet archive from Brussels to Mons, as well as the agreement between Google and the Mundaneum Archive Centre, signed in 2013, based on future opportunities for that region.

In a press release from 20 March 2014, posted by William Echikson, Head of Community Relations, Europe, Google expressed its plans to support the city of Mons during their role as European Capital of Culture in 2015: “One of Google’s two major European data centers is located just down the road from the city, making us a major local investor and employer. It is only natural that we want to help put some sparkle into the city’s ambitious capital of culture plans.”³³ Those plans include the digitization of architectural *treasures* using their Street View cars and trikes, as well as support for the Mundaneum and their planned exhibition “Mapping Knowledge.”

Snelting has been following the relation between the city of Mons and Google in relation to the legacy of Paul Otlet: “From the side of the Mundaneum, there has been a lot of work in pursuing or even staging the story that ‘Otlet invented the Internet’ and, subsequently, that ‘Otlet was the visionary inventor of Google’.”³⁴ In their own press release, Google clearly communicates its own narrative: “Together, we are bringing high-level speakers to the city to explore Internet issues. Our own chief Internet evangelist and ‘father of the Internet’ Vint Cerf recently visited and presented his vision of the future to a packed audience at the city’s 600-seat Manège Theater.”³⁵

Snelting also points out that the GAC section on the Mundaneum is published under their own URL, “maintaining the draconian terms and conditions of Google and erasing all sense of distance between the public and the commercial ‘institute’”: <http://digitalarchives.mundaneum.org>. As far as I know, the Mundaneum does not make any other efforts to publish digital documents online elsewhere. Well, on YouTube and Facebook, of course.”³⁶ It is not clear if the GCI contributes money to the Mundaneum.

According to Snelting, it all seems to be a case of exposure and “communication opportunities” solicited by the Mundaneum itself. However, the intervention of Google in cultural politics comes at a time when cultural institutions are short on funding and have to deal with the economic and access demands of a networked culture.

If Google bankrolls the digitization process, public institutions do not need to rely on public money. This pathological relation is also the core tenant of

welfare capitalism, “where people are referred to corporations rather than states for such services as they receive; where corporate capital routinely arrogates to itself the right to broker public discourse; and where history and art remain saturated with the preferences and priorities of elite social classes.”³⁷

I visited the Mundaneum recently. On the second floor there is an interactive installation interpreting Otlet’s legacy. It was made by Google.

VI.

I search for “gigapixel” in Google Arts & Culture. There are 1,282 images available in gigapixel quality, that is, bitmap images composed of a billion pixels. Another search: “gigapixel, Indonesia.” The result are seven items related to Indonesia but from partner collections elsewhere. I continue exploring, scrolling, clicking on Manet’s *In the Conservatory* (1879). I zoom to the limit. It may very well be the case that I can discover much more about a picture in ultra high-resolution brush pixels than from one meter away behind a bouncer. Granted. The details on the cracks are pretty neat, but half of the eye area in the man’s face I am exploring is pixelated. It might be my Firefox. I switch to Google’s Chrome. Most of the images available in gigapixels represent the so-called “canon.” High resolution for high culture, gigapixels as the gateway to these masterpieces, gems, and national treasures.

In the images of the GCI, every pixel is charged with meaning. But wasn’t this what museums have been doing forever? Charging each material quality of an object with a meaning determined by a certain context? No matter its resolution, information is a different version of the thing it represents; objects in museums are different from the digital copies of

them, but a dematerialized art object, as Hito Steyerl tell us, “turns out to be perfectly adapted to the semioticization of capital, and thus to the conceptual turn of capitalism.”³⁸ According to Google, such images contain around seven billion pixels that “enable the viewer to study details of the brushwork and patina beyond that possible with the

naked eye. Hard-to-see details suddenly become clear, such as the tiny Latin couplet which appears in Hans Holbein the Younger's 'The Merchant Georg Gisze.' Or the people hidden behind the tree in Ivanov's 'The Apparition of Christ to the People'.³⁹

This also makes it possible to identify errors in the mosaic that compose gigapixel images, a find which can be considered positive as it helps us to understand the material basis that sustain the narrative around high-resolution culture. On the one hand, this narrative divides art from technology through the material process of digitization—which relies on energy, light, photographic equipment, dead and human labor; on the other hand, it insists on the “great things” that happen where art—as digital copies—and (information) technology—as database—meet.

“The digital is a regime of energies: human energy and the energy needed

for technological machines.”⁴⁰ For this, we must consider that encoding information—digitizing, archiving—is not an activity that takes place in a distant future, since “it produces as much as it records,” as Derrida once told us;⁴¹ it is a present and continuous task, as well as mundane and repetitive labor, far away from preservationist ideas of culture. And one that in the case of Google will go on forever, since the mission of organizing and archiving the “world’s information” will never be completed. Now, the words of Friedrich Kittler resonate: “All these immense flows of modern media [...] can be reduced to two numbers, zero and one, [...] and we can digitalize [...] paintings, and movies and symphonies, and pop songs, and the rest of the forms of yesterday and tomorrow, and tsunamis, and what else. Everything which is beautiful can be encoded, [...] but it does not make sense to encode for eternity.”⁴²

VII.

I searched for videos related to the Google Cultural Institute to discover more about its history. I had to go to YouTube. There is a “behind the scenes” of the Art Project: images of cities like Paris, Mexico City, Vienna, and their museums. Two men sitting at a table with computers command the gigapixel camera. There are ladders and scaffolds. Impressive and professional illumination sets. Assistants unfolding works for the Google gaze. Dollies and tripods. The video also shows the trolley that creates the 3D spaces of the museums. The time lapse conveys dynamism. Activity. There are no visitors around this activity. The digitization process seems to be an activity isolated from the public. I imagine this spectacular process may well happen at night, when the museum is ironically empty. There is also a video about the Google offices in France entitled “Inside Google

Paris.”⁴³ A man is very happy about the meaning of the institute as a long-term investment in France. Employers praise the free food, especially the tea. A close-up of a table with different kinds of cheeses. You hear both French and English. “It really is an international environment,” someone says.

In France, an acronym is used to describe the “American cultural imperialism” fuelled by Silicon Valley: GAFA (Google, Amazon, Facebook, and Apple).⁴⁴ The Palace of Versailles and the Musée d’Orsay were among the first institutions to join the Art Project. The Google Cultural Center Headquarters in Paris was inaugurated on 10 December 2013, though the highlight was the last-minute cancellation of an appearance by Aurélie Filippetti, the former French Culture Minister.⁴⁵

On the jobs page at google.com, the French headquarters is described as “a brand-new office in a renovated *hôtel particulier* on the Rue de Londres. We enjoy the same Googleyness you get in Mountain View—check out the giant cow in the courtyard—but with distinctly Parisian touches like wine and cheese for TGIF meetings, a Citroën deux chevaux-turned-phone booth and a cafeteria nicknamed Les Deux Algos (short for algorithms).”⁴⁶

Paris is also the capital of the first country in Europe that launched an offensive against “Googleyness” by proposing a greater taxation on search engines. While Sarkozy’s arguments were extremely nationalistic and reactionary, of importance is the reaction by Google, who appealed to that same sentiment of cultural nationalism in order to sustain their economic expansion of the company by invoking “culture as data.”⁴⁷

In Wallace’s time, a similar transformation occurred: “In the eighteenth and nineteenth centuries, ‘Nature’ is increasingly replaced by, ‘Natural Resource,’ focusing on those aspects of nature that can be appropriated by human use—on a large, industrial scale.”⁴⁸ For Google, too, culture is a material that can be replaced by the notion of data.

Nature turned into Culture turned into Data.

VIII.

I can’t save the images from the Google Cultural Institute, but only re-organize them within their interface to create “galleries.” A disclaimer is displayed in the beginning of a gallery made by a peasant user: “This user gallery has been created by an independent third party and may not always represent the views of the institutions, listed below, who have supplied the content.” I don’t want to make a gallery inside the Google Cultural Institute, I want to make my own collection. I want to save the

images, print them, and create a copy of the information. I will print my own labels. I've been exploring some options, and I need to Wget, which is a command line used to get stuff down from the World Wide Web.⁴⁹ I asked a friend to help me sort it out. I copied the HTML source. The file was huge, there were thousands of lines. I manually removed everything that was not useful for me, until there were left about 100 sections each containing five lines. In them was the Title, Date, Location, Partner, and Image URL. This is enough to create the labels of my collection. Save file: indonesia.txt. Then, I run a command line in my terminal: wget -i indonesia.txt.

*Maybe I need some other options: wget-content-disposition
-trust-server-names -i indonesia.txt.*

*Something like this: https://unix.stackexchange.com
/questions/61132/how-do-i-use-wget-with-a-list-of-urls
-and-their-corresponding-output-files.*

Free access to information is a good principle, but it will always require us to understand the contemporary conditions, meanings, and different contexts under which “free access” takes place—as well as its limitations. Access to information is not much without making collective sense of it. As Jussi Parikka reminds us, “Freedom, communication and the intelligence of the crowds—direct democracy—are such lovely aims that no one expects a horrible dictator would dare to object but at the same time the actual technologies and techniques that sustain those ideas are more complex.”⁵⁰

The context of the GCI is very complex—institutional and corporate, public and private, planetary and local. Given the proportions of its political, economic, and now cultural agenda, it also generates many grey zones. In between the “free” and the “access” there

is a space, a grey zone for action, a place to “remind institutions,” as Snelting emphasizes, “of their own potential. To imagine that institutions, infrastructures, practices of archiving, and the materiality of the documents themselves might act differently.”⁵¹ It is a grey zone “between the private sphere and the public sphere” that requires communities to engage with “a common selection, indexing, re-situation and actualization.”⁵²

At the moment, GAC still follows the Eurocentric logic that gave birth to the nineteenth-century museum. Does “free access” make the Google Cultural Institute at large a critical public institution? Perhaps it is more relevant to ask: Would a publically funded institution that gives its visitors the same “free access” granted by the GCI be more critical? A possible answer, as well as a remaining problem we still face, is

“abundance, not scarcity. What counts in the end is action, not access.”⁵³ Similarly, the Spanish philosopher and curator, Paul B. Preciado, has questioned how a museum can act not “as colonial technology but as a critical and reflective apparatus proposing other ways of

managing the archives, other forms of representation, other world-fictions.”⁵⁴

Institutional museum culture never decolonized itself; it just globalized, and is now Googified.

IX.

While comparing my indonesia.txt file with the information on the Google Arts & Culture website, some words related to certain objects from the Museum Nasional di Indonesia—like *kris*⁵⁵—begin to become more familiar, as do their images. I note too that many of the images were created by “Unknown.” Some of them have no specific date in their description. The images have good resolution, but no gigapixels for peasant users like me. I opened all the images in PhotoShop, erased the background and resized them to fit the archival labels I bought in OfficeMax. I organized them into different sheets to print all ten of them at once. I then printed the images, cut them, glued them. I also compared the text file with the GAC content, before printing the tables I prepared in OpenOffice. Check again, and again, I only have so many labels. I organized them in the same order as the interface shows them to me in Google Arts & Culture. I copied the collection. I am working with it. No more scrolling. When I printed my labels the exploring-by-color mode did not exist yet on GAC, so some color palettes start to emerge from my prints. The statues have a distinct grey. Other statues are made of wood; the forms of these objects are more linear, dominated by a reddish wood tone. My favorite object is this beautiful water dipper in the form of a shell, made of gold. When you stop scrolling, you start to learn. I already assigned hierarchies: the shell vessel, the Rangda mask, and the Jambhala statue. These are my favorite images from the collection of the Museum Nasional di Indonesia.

Hierarchies always exist in culture. In Google Arts & Culture, museums are “partners” with different hierarchies. The more access you give to its team, the more data the museum will have in its database, the more “visible” it will be: “Power solicits communication. [...] In communicative capitalism, images and signs acquire value and/or power by means to be seen.”⁵⁶

Many have made comparisons between Google Arts & Culture and art theorist André Malraux’s *Le Musée imaginaire*, based on the fact that the capabilities of image reproduction shape the visual elements that define our understanding of art. The colonial impulse that often attends archival practices was also present in Malraux’s *Musée imaginaire*. Much like Google, Malraux used photography techniques, as well as biased selection and post-production processes, to capture reproductions that stripped the resulting images from their contexts in order to

compare them by direct juxtaposition. For, in the mind of Malraux, “the great work of art belongs to history, but it does not belong to history alone.”⁵⁷ One could be lazy and easily imagine Malraux excited about GAC.

Looking back from the present, the *Musée imaginaire* could also be seen as a grey zone—almost literally—between the nineteenth-century colonial museum and the twenty-first-century techno-determinist Google Arts & Culture website: it was not an institutional collection but neither was it a database; copies were used, yet they were not digital. But mostly, Malraux’s “museum without walls” was indeed imaginary, without built architecture, without terms of service, without an interface, and free of marketing and branding.

Let alone stored in a data-center owned by a Silicon Valley company.

X.

I found a small grey zone in between the archives and the networks, the peripheries and the centers, culture and data, the Google Arts & Culture and the Museum Nasional di Indonesia, Alfred Russel Wallace and Google, information and technology, the Eurocene and the Technocene, and the distance between you and me.

I am a peasant user and this is my imaginary collection, a strategy for turning the techno-colonial archive against itself.

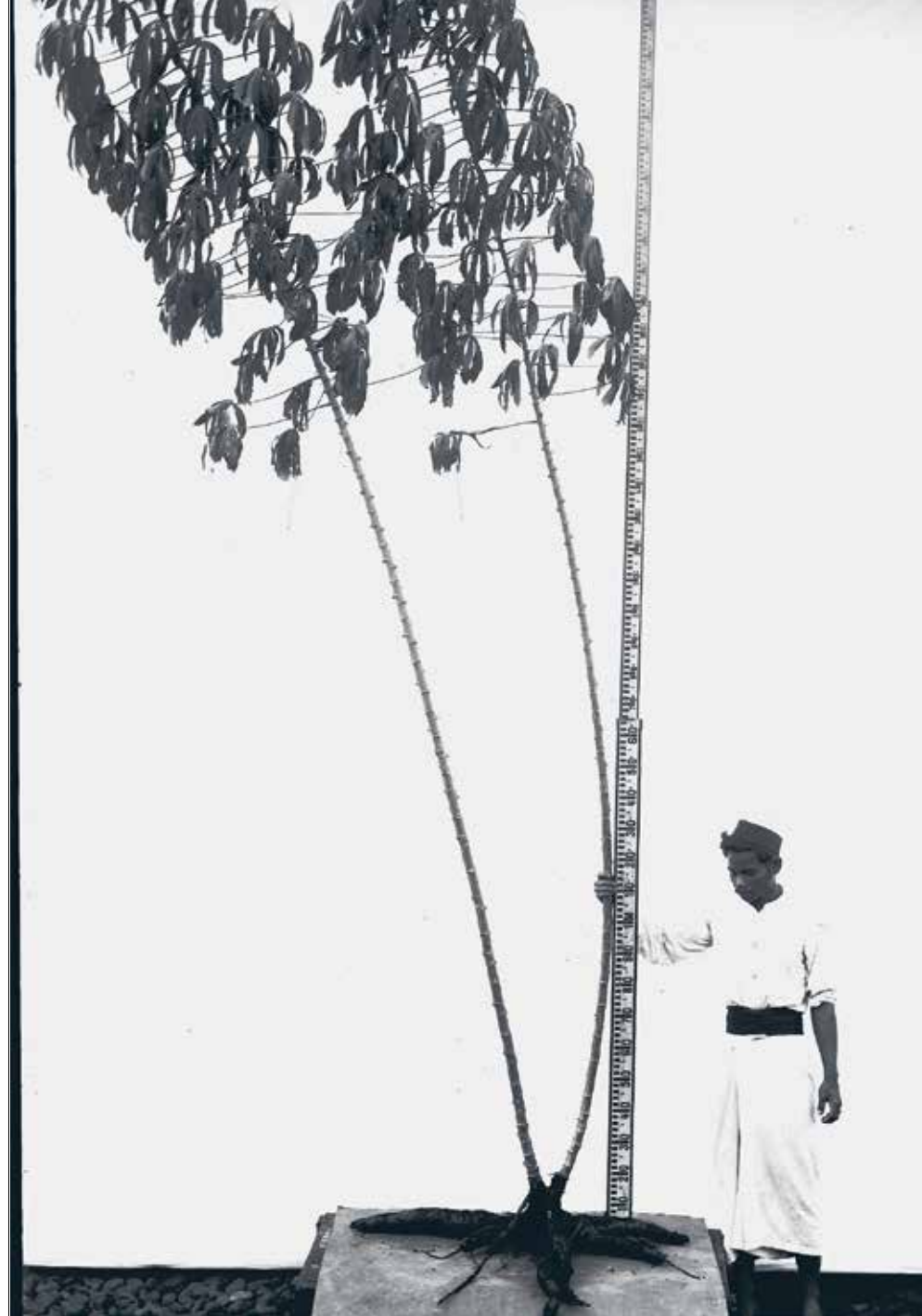
Intercolonial Technogalactic.

Organizing information is never innocent.

This essay is a revised and expanded version of an earlier essay developed in 2015 as part of Juárez’s installation of the same title for the exhibition *125,660 Specimens of Natural History*, Komunitas Salihara, Jakarta.

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- 54 See <http://www.macba.cat/en/decolonising-museum>.
- 55 The *kris* is a type of ritual knife that is "most strongly associated with the culture of Indonesia. The *kris* is also indigenous to Malaysia, Thailand, Brunei, Singapore and the southern Philippines where it is known as *kalis* with variants existing as a sword rather than a dagger. The *kris* is famous for its distinctive wavy blade, although many have straight blades as well," <https://en.wikipedia.org/wiki/Kris>.
- 56 Irmgard Emmelhainz, "Images Do Not Show: The Desire to See in the Anthropocene," *Art in the Anthropocene*, eds. Heather Davis and Etienne Turpin (London: Open Humanities Press, 2015), 136.
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Measuring a specimen of cassava, or *Manihot esculenta* (also known as yuca and manioc), Buitenzorg Botanical Garden, Bogor, Java, circa 1900. Image from the exhibition *125,660 Specimens of Natural History*, Komunitas Salihara Gallery, Jakarta, 2015. Courtesy of the Indonesian Institute of Science.

Akademi Drone Indonesia: Excerpts from Field & Sky

According to a report in *The Economist*, in 2010 the Federal Aviation Authority estimated that the total number of consumer drones in the United States might reach 15,000 within the decade; by 2015, there were at least that many drones being purchased every week.¹ More recently, a report by Grand View Research projected that the global consumer drone market size would reach USD \$4.19 billion by 2024.² However, many activists have also been working to utilize consumer-grade drone technology and image processing for social and environmental justice struggles. The Open Drone Map (opendronemap.github.io) project allows users to share and tag imagery and access open-source software for processing. WeRobotics (werobotics.org), founded by Patrick Meier, has also been advancing the use of unmanned aerial vehicles for humanitarian response and recovery.

Founded in 2014 by Radjawali Irendra, Akademi Drone Indonesia [Indonesian Drone Academy] is an organization dedicated to research, education, and policy about unmanned vehicles for terrestrial and aquatic research and advocacy, particularly regarding environmental issues. Akademi Drone is focused not only on the training of drone pilots, but also contributes to policy discussions about safety, licensing, and metadata protocols. Because the volume of drone imagery data can be challenging for many organizations, Akademi Drone sees its work as much in the design and maintenance of digital objects and databases as it does in field-data collection. What follows are annotated images that demonstrate how grassroots aerial imagery is being used to support environmental struggles, emboldening a new generation of activists to contextualize the violence of resource extraction in the archipelago.

All images courtesy of Radjawali Irendra/Akademi Drone Indonesia.

- 1 "Welcome to the Drone Age," *The Economist*, 26 September 2015, <http://www.economist.com/news/science-and-technology/21666118-miniature-pilotless-aircraft-are-verge-becoming-commonplace-welcome>.
- 2 <https://www.grandviewresearch.com/press-release/global-consumer-drone-market>.



Fig. 01. The Beguruh nursery and reforestation site of the NGO Friends of the National Park Foundation, in Tanjung Puting National Park, Central Kalimantan.



Fig. 02. When forest areas are legally designated as *hutan produksi* [production forests], they become property of the state, effectively denying residents access to or use of the forest, as in the case of Desa Sejotang, West Kalimantan.



Fig. 03. The "Mega Rice Project" was an authoritarian agricultural experiment funded by the World Bank and carried out by the Soeharto regime in Central Kalimantan in the 1990s; this image shows remnants of the canal infrastructure used to drain the peatland for rice plantations, as well as areas burnt during the massive peat fires, which occurred in the region in 2015.



Fig. 04. When old-growth forests are cut into fragments, biodiversity suffers. Sites such as this bauxite mine, which is located on land that was annexed outside of the legal concession given to its parent company, show the fragility of these fragmented parcels of forest in West Kalimantan.



Fig. 05. Illegal bauxite mining led to the desiccation of Lake Semenduk, a local source of fresh water and fish, in West Kalimantan. Following an investigation by authorities—prompted in part by this image—operations on the site were closed down.



Fig. 06. Drone imagery is fundamentally composite; photogrammetry processing involves the identification of common pixels across multiple images, which can then be programmatically synthesized into a single, high-resolution image, as in this drone photograph of the forest canopy in Central Kalimantan.

A Future Without Forests

by Matthias Glaubrecht

The simple cabin made of logs and sago palm fronds in Dodinga on the island Halmahera in the Moluccas—where the British naturalist and specimen-collector Alfred Russel Wallace allegedly wrote the manuscript of that famous article that so shocked Charles Darwin—has of course long decomposed.¹ Seemingly endless rows of oil palms surround the simple village and the lowlands on both sides of the narrow strip of land. The tropical rainforest where Wallace hunted for butterflies and birds has vanished, and with it many of the inhabitants of this singular—because insular—habitat.

Today, it is also impossible to discern the house on the neighboring spice island of Ternate that for many years had served Wallace as a base camp during his expeditions across the island world of the Moluccas. The environment here has completely changed. The city—now jammed in between the ocean coast and the steep volcanic cone—has expanded heavily towards the north and south, and more than 160,000 inhabitants densely populate the entire island.

A third area Wallace visited several times was the island of Ambon in the center of the Moluccas. Upon steering into the natural port of Amboina, enclosed by the island's southern peninsula, he was impressed by the coral reefs that rose up close to the surface of the crystal clear ocean. In this water, incredibly rich in marine organisms, he saw an armada of colorful fish, anemones and other anthozoans, as well as other animals such

as starfish, sea urchins, sea cucumbers, and turtles. Submerged below, the branching and interlacing structures of the corals presented a wild diversity of life similar to the rainforests up on the land.

When one visits the bay of Ambon today, one encounters an overflowing, bustling city, with streets and settlements stretching to the northern edge, displacing and supplanting the forest. The coral reefs and their countless marine inhabitants in the bay have long vanished. The rivers descending from the ridge of the southern peninsula now flow into a bay that has completely silted. As everywhere in Indonesia, the rivers are used as the city's sewers, flushing refuse and garbage directly into the sea.

In both his travels and his theories, Wallace was able to advance into new regions—*terrae incognitae* full of wonders and species hitherto unknown to science. But the world he saw and discovered for European science in the mid-nineteenth century has today disappeared. While one might assume the habitats and organisms he once visited and encountered were lost gradually and continually over the last 150 years, the most significant and largest exploitation actually happened only recently. Indeed, the reckless and radical deforestation of the diverse rainforests, the establishment of endless, homogenous oil palm plantations, and the expansion of overflowing human settlements encroaching on natural habitats is the work of a single generation—our own.

Singapore and the End of Nature

The sole exception to this narrative is the island state of Singapore, where Wallace arrived in April 1856, because here the forests had vanished early on. Singapore therefore provides a model for understanding what happens when we lose the expanse of Wallace's world in other places—albeit without the prospect of ever copying the city-state's unique economic success. While at the beginning of the nineteenth century, Singapore was a British colony with only a few hundred inhabitants, today its population has grown to more than 4.5 million. Urbanization has displaced more than ninety-five percent of the tropical rainforests, which once covered the island. Large-scale logging and deforestation, the people's passion for hunting, and the excessive development of the city have eradicated about half of the region's endemic species. However, some animal groups record much greater losses, with negative numbers of freshwater fish and mammals being as high as eighty or ninety percent. Initially, the forests were cleared for *caoutchouc* and pepper plantations; later for roads, settlements, ports, and industrial development. In this process, ever more organisms suffered great misfortunes when their habitats were torn away. Today, only a minuscule quarter percent of the total area of Singapore remains forested—and it is here that the remaining species are crowding together. Most of them are threatened by extinction, with some of these species already counting only a mere handful of surviving animals. Regarding such statistics, it should be noted that we tend to record them with a special bias towards attractive or otherwise ostentatious species, while overlooking the conditions of innumerable others.

Tigers, for instance, used to be so numerous in the Singapore of Wallace's era that they are said to have killed on average one person per day; in 1857, tigers caused a total of 390 human fatalities. Back then, Bukit Timah, the woodlands where Wallace initially went to search for insects and birds, was located a little outside of Singapore's city limits; today, this nature reserve is one of the last fragmented forest relics. Long ago, the big cats were so common there that the natives used to call the area "Tiger Resort." Forty years later, in 1896, one of the last tigers was killed here. With 1930 marking the "official" date of the species's extermination in Singapore, it is solely the name "Singa-pura" that continues to evoke a big cat—although the name actually doesn't even refer to a tiger, but to a lion, a species which never existed there.

Elsewhere the *Panthera tigris*—which originally spread from the Asian continent via Sumatra to Java and Bali—did not fare much better. The smallest and darkest subspecies of the tiger living on the easternmost of those three islands, Bali, became extinct the soonest. The last *balica* was shot near Sumbar Kima in the west of the island on 27 September 1937. In the 1940s and early 1950s rumors of alleged sightings emerged, but such proclamations tend to be voiced regarding almost every other large species just after humans have exterminated them. They evoke the phantom sensations of amputated limbs—it is not until things are finally gone that we notice them. Not more than a few skulls, bones, and skins have survived in the collections of some European museums, and these objects are the only remaining evidence that the Bali tiger ever existed.

Around 1900, an estimated 100,000 tigers were alive in Asia, whereas today hardly more than 3,000 of these animals remain. Originally diurnal, these *Felidae* have long been

displaced—both into the night, as well as the national parks. Still, these creatures are hardly guaranteed to survive for much longer in the wild. Four of the eight tiger subspecies have been exterminated in the wild through hunting and poaching; the extermination of the few remaining and dispersed individuals of a fifth species is imminent. Among these species are the Caspian tiger and the Bali tiger, as well as the tiger that used to live in Java and Sumatra (already today more individuals of this subspecies live in zoos than in the wild). In the 1950s, around 4,000 tigers of the southern Chinese *Panthera tigris amoyensis* lived in China; by 1982, at best 200 of these animals were left. In the early 1990s their last traces were found, and since 2000 this subspecies has been considered extinct. The dozen tigers remaining in Chinese zoos are no longer thoroughbreds, but are considered cross-breeds with the *Panthera tigris corbetti*, the Indochinese tiger.

But for Wallace the world was still different. In Singapore, he found traces of tigers that had been hunted with traps; in Bali, he witnessed the locals reporting the presence of a dangerous big cat. He could still see with his own eyes the peculiar distribution patterns of entire faunas. Since then, many of these species have ceased to exist. If you visit Singapore today on a layover and go to one of the park-like resorts on the smaller offshore island of Sentosa, you will encounter only displaced species that originally didn't exist there; the Myna bird from India, for example, or peacocks displaying their plumage next to the yellow-crested cockatoo from Australia. The Wallace Line running between Bali and Lombok has also faded, with innumerable animals having been displaced on both sides of the *Wallacea*—if they have not been entirely exterminated.²

While one might respond that the disappearance of the Wallace Line will only bother a few zoologists concerned with historical biogeography, deforestation, and the loss of endemic species, the displacement, mixing, and infiltration of foreign faunal elements are phenomena whose consequences are not by any means exclusively relevant to scientists. Thus, nature's expulsion from Singapore is suggestive of the larger trajectory—Southeast Asia expects to lose two-thirds of its old-growth rainforests by 2100, as well as nearly half of its originally rich diversity of plant and animal species. Not only will the Wallace Line be obscured, but all those species that demarcate its boundary through their habitat will also be lost—many if not all of the butterflies, birds, and mammals he once dedicated eight years of his life to studying.

Looting the Borneo Rainforests

Species extinction is happening faster and with a wider scope today than in any period of history. Sumatra, Sulawesi, Borneo, and New Guinea seem to be locked in a competition for the most expeditious deforestation. What took nearly 180 years to happen in Singapore has been brought about on these other islands by a single generation since the 1980s. In this process humans are the perpetrators; in a globalized world, each of us is indelibly implicated in the cause, just as our children will be implicated in the consequences.

Wallace's world disappeared nowhere else as dramatically and rapidly as in the interior of the Malay archipelago. When Wallace reached the Sadong River in Sarawak, Northern Borneo (Malaysia), in 1855, he found the richest hunting

grounds in freshly logged mining areas at the edges of otherwise still untouched tropical rainforests. In places where predominantly Chinese miners had "prepared the table" for him with rotting bark for beetles and other insects, the collecting naturalist already benefitted from the colonial looting of natural resources in order to study processes of natural production that were, to him, as foreign as they were magnificent. Today, this kind of nature no longer exists.

On Borneo, large-scale environmental looting began in the 1980s when the loggers working for international lumber corporations arrived. They were the first to attack the lowland rainforests along the coasts of this gigantic island. While between 1880 and 1980 the annual forest loss was estimated at only 0.3 percent, in the past three decades this number rose to 1.4 percent per year. At first sight, this may not seem like a very dramatic statistic; in reality, such losses are both massive and irreversible.

Following Greenland and New Guinea, Borneo is the third largest island in the world. It is two and a half times as big as Germany. The approximately 5,000-kilometer coastline was once enclosed by mangrove forests. During Wallace's expedition, very few of the island's bays could be accessed for settlement construction because the majority of the land was covered with tropical rainforests all the way to the mountain tops. Until thirty years ago, this was true for eighty percent of the island; until twenty-five years ago, for seventy-five percent. Until the 1980s, the rainforests of Borneo were counted among the regions with the highest biodiversity on Earth, including 15,000 species of flowers (as many as in all of Africa); more than 3,000 species of trees (finding more than 1,000 of these species on a single hectare plot was a world record); up to 750

of the 2,000 known species of orchids; 221 mammals; 622 birds; as well as more than 400 different species of reptiles and amphibians (including around 80 lizards, 140 snakes, and 160 frogs). And through further incursions, new species are continuously discovered; in the last few years, a total of 360 new species were discovered in Borneo.

The natural biodiversity of Borneo is disappearing as the island's rainforests are logged faster than anywhere else in the world. According to one study, more trees were logged in Borneo over the last two decades than in Africa and South America combined. Another study has shown that in Kalimantan, the Indonesian part of Borneo, more than half of the tropical rainforest was lost between 1985 and 2001, with devastation occurring on average at 1.3 million hectares of forest per year. In 2008, Indonesia made it into the *Guinness Book of Records* for being home to the world's highest deforestation rate. Recently, more than two million hectares per year were logged in the country. Read in terms of its speed, every one minute Indonesia destroys an area of forest equivalent to the size of five football fields—about 150 hectares per day. In less than a decade, the lowland forests of Borneo will have disappeared entirely.

No other country has destroyed its natural inheritance as fast or as thoroughly as Indonesia. The next generation of Indonesians will inherit no rainforest. Not on Borneo, and most likely not on any other island of the archipelago. Since the 1950s, the forests of Indonesia have been reduced from an estimated 162 million hectares to approximately 88 million hectares—a reduction of at least 74 million hectares. This loss of forty-five percent equals an area about the size of Germany. Yet, taking current trends as an indication, there is no end in sight.

War Against the Jungle

Screaming chainsaws are heard everywhere in the forest as loggers topple sylvan giants through clear-cutting and slash-and-burn plantation development; these ecosystems are being changed irreversibly. The images of tropical deforestation have become well-known in recent years as the European media relay the advocacy efforts of local environmental organizations fighting to combat the trend. However, the circulation of images does not mean that effective action is being taken to prevent the imminent anthropogenic climate change that is the inevitable consequence of deforestation.

Instead, the war against tropical nature continues in the planet's most fertile forests, with revenue-dependent government agencies, corrupt officials, international "forest products" corporations, and local timber dealers all implicated and entangled. The players continue to send loggers—the poorest of Indonesia's poor—into the woods. The sales of illegally logged and illegally exported timber fill both public accounts and private pockets. Conservationists estimate that three quarters of the wood imported to Germany still originates from illegal sources. Permissive authorities, an absence of enforcement, and pure financial incentives for unrestricted profits have driven the system entirely out of control. In 2003, during a meeting of the most powerful creditors, the Indonesian government declared its own moral bankruptcy when announcing that it was unable to control rainforest deforestation within its own borders, and instead urged the international community to stop importing illegal timber. At the same time, Indonesian authorities facilitated the movement of huge quantities of tropical wood into neighboring

countries to await the required papers for its sale on the international lumber market. But it is not simply the corruption of government and the forest products industry that is to blame; in a global market, every consumer destroys his or her own little piece of the rainforest.

In the meantime, logging has become increasingly lucrative for two reasons. First, the most valuable tropical tree species—Meranti and Ramin—were pulled out of the forests individually through selective logging for many years; selling this wood was highly profitable. But because further profits were sought after, the remaining forests were secondarily made into pulp—literally. Massive concessions enabled large-scale land-clearing in order to supply the pulp mills of international paper companies, who in turn supplied the offices of affluent European businesses with seemingly endless reams of printer and Xerox paper. Finally, in a more recent turn, the extensive cultivation of the oil palm *Elaeis guineensis* became the new super-business upon which Indonesia's GDP continues to grow. Everywhere in Indonesia, oil palm plantation ventures have enriched the plantation owners, corrupt community leaders, and government authorities. Many people in this emerging economy are excited by the promise of wealth and prosperity guaranteed by these plantations; but it is both the poor and the rich who collude, with varying degrees of consent, to annihilate the natural bounty of Nusantara.³

Over the past two decades, the extent of the oil palm plantations has expanded tenfold. At present, for every individual tree in the rainforest there are hundreds of thousands of oil palms. The oil, which is pressed from the palms' fruits, is hidden in a huge palette of products—ranging from margarine and other processed foods such as frozen pizza and cheesecake

to cosmetics, including lipstick. The demand for palm oil continues to increase—over the past years by an average of fifteen percent each year. And such demand has increased even more ever since we've started mixing biofuels into gasoline and diesel. For this reason, forecasts that predict a doubling of the demand for palm oil by 2030, and a tripling by 2050, could well be accurate. In many places, this would mean the final death-blow for the remaining rainforests and their flora and fauna.

But it is not only Kalimantan that is subject to the logic of the timber mafia, the palm oil industry, and the violent dependencies these colluding corporations have generated. In 1982, eighty percent of the province of Riau (which is the size of the Czech Republic), on the island of Sumatra, was still covered by tropical rainforest. Subsequently, it took a mere three decades to annihilate around sixty-five percent of the region's primary forest. Everywhere government officials permitted this predatory accumulation of nature's treasures to thrive, accelerating the destruction more recently with the introduction of ever more oil palm plantations. Everywhere we can witness—especially by actually visiting a plantation site, but also simply by way of Google Earth—how logging, fire-clearing, and the development of oil palm plantations continue to advance toward the last remaining areas of tropical rainforests.

A Veritable Massacre

When considering the loss of rainforest regions and the subsequent cultivation of oil palm plantations, an aspect of the process frequently overlooked is the resulting hundreds of

thousands of species that perish. Not all of their fates are as visible as that of the orangutan, a species Wallace had been especially infatuated with, but one which he nevertheless had few hesitations about shooting for museum collections. Of all the animals suffering as a result of deforestation, the orangutan—literally the “man [*orang*] of the forest [*butan*]”—is the animal species most closely related to humans. Vast regions of the orangutans’ habitat in Borneo and Sumatra have been destroyed. While until 1990, 150,000 orangutans still existed in Borneo, by 2000 their numbers had already shrunk to 55,000; this means it took only two decades to obliterate two thirds of their population. On Sumatra as few as 7,000 of the formerly 200,000 *anthropoids* survive. According to estimates of the environmental program of the United Nations, over the next ten years these red-haired great apes might have disappeared from the wild entirely. Clearly, the orangutans won’t be able to survive in their natural habitat where Wallace had once observed them because, by 2020, this habitat will have almost entirely ceased to exist. In Sabah, Malaysia (northeast Borneo), orangutans already survive only in reservations such as the rescue station of Sepilok, where the animals are kept as a spectacle for tourists without any hope for future re-wilding possibilities. Where could they be returned to given the current devastation?

While the orangutan is a charismatic and well-known species, we perceive the loss of other animals less easily; studies and exact numbers are often lacking. Yet one thing is certain: if the clear-cutting of the forests wasn’t already bad enough, the loggers who cut wide corridors into the woods are typically followed by unscrupulous poachers and animal traders. The Sumatran rhino has been reduced to fewer than 300

individuals in the wild. Likewise, the Javanese rhino, its own subspecies on the island of Java, is on the edge of extinction. The same is true concerning the Asian elephant and the Sumatran tiger, of which there are currently very few individuals left—if at all. Proboscis monkeys, clouded leopards, sun bears, gibbons, Bali starlings, hornbills, and thousands of other endemic species aren’t doing any better. For invertebrates, butterflies, beetles, and other types of insects—some of which will have disappeared forever before they were ever even known to science—the entire ecosystem is under siege.

Extinction in Amazonia

Other regions of the world are facing a similar situation. In Africa, the tropical rainforest is disappearing by 0.4 percent annually, while in South America this is happening by 0.5 percent. These numbers are surpassed in the Caribbean and Central America, where annual logging rates reach up to 1.2 percent a year. In the Indo-Malayan region, a mere one percent of such forests are left intact, which are home to an original fauna of large mammals. In Africa, one tenth of the original large forests still remain. In the American tropics, especially in the Amazon region, the loss is up to one third.

Biological diversity isn’t distributed evenly across the Earth. Instead, three quarters of all animal and plant species live in the tropical rainforests along the equator, an area which only covers seven percent of the world’s landmass. Half of all mammal species in the world roam the jungles of only three countries—Brazil, Madagascar, and Indonesia. Scientists believe that the forests in the Amazon (predominantly located

within Brazilian territory and amounting to no less than forty percent of the world's tropical rainforest) are home to sixty percent of all of the organisms on the planet. A single hectare of Amazonian forest contains up to 400 different types of trees—ten times more than what exists in all of Central Europe.

Satellite images also show the massive destruction of the Brazilian rainforest. Here, soy plantations and cattle feed lots inexorably maraud their way into the forests—with the resulting landscape taking on a patchwork appearance. Since 2001, the agrarian zones of Brazil have grown by twenty-one percent—while the time it takes to deforest an area has today accelerated by thirty percent compared to only eight years ago. Illegal logging has also increased again; since 2010, illegal practices have risen to more than double the previous numbers in the Amazon.

In the northeastern part of the Amazon basin—where the rainforest is subject to Ecuadorian law—there still exists one of the largest uninterrupted jungle areas on Earth. Here, in the Yasuni National Park, a single hectare of forest boasts biodiversity as rich as all of Mexico, the U.S., and Canada combined. This forest is nevertheless threatened by plans to extract its immense underground petroleum fields. It appears that Ecuador will succumb to the lure of petro-dollar profits, especially after the proposal of the Ecuadorian president to have other nations pay for the conservation of the forest hardly resonated among the international community.

Forest Clearing and Climate Change

Since forests act as storage for local carbon emissions, deforestation has far-reaching global consequences for every creature on Earth. Logging in the Amazon and fire-clearing in Borneo both accelerate the rise of global temperatures because of the mass of carbon these activities set free. So, in addition to the destruction of biodiversity, massive forest loss is a disastrous process, causing a quarter of all total global carbon emissions. If the statistics of the irredeemable destruction of the tropical rainforests already sounded dire, adding this accelerated carbon release all but guarantees a future without forests.

After the U.S. and China, Indonesia is the third-largest producer of greenhouse gases. The two world powers emit a lot of carbon dioxide because they consume such great volumes of fossil-fuel energy. With much less industry, Indonesia emits such high numbers because the country continues to permit reckless deforestation and burning in order to profit from logging and palm oil. Indonesia and Brazil have both made repeated demands over how other, more affluent nations should compensate them for the economic loss associated with a reduction of deforestation. During recent climate summits, representatives from both countries declared their expectation for financial transfers in the billions to compensate for forest conservation. For years, corrupt officials in the Indonesian government have lined their pockets with the profits made from deforestation and monocrop plantations; it appears they have now identified another chance for profiting from forest conservation and emissions trading. Disaffected, they look on as the depletion of the rainforest destroys both biodiversity

and the livelihoods of subsistence communities, while massively endangering the planet's climate. But what is at stake is also more than the rainforests—looking beyond immediate profits, endless consumption, and excessive greed, humanity threatens itself with extinction on an irreversibly damaged planet.

The wondrous biodiversity that allowed Wallace to perceive the evolutionary dynamics of nature has been rendered the victim of a planetary anthropogenic conflagration. In an article from 1863 about the geography of the Indo-Malayan archipelago, Wallace wrote that the urbanization and destruction of ever more territory by the human species would lead to the disappearance of many forms of life. Yet, in this process, we also destroy the valuable evidence of life's history on the planet as surely as we turn the life of so many species into a lost history.

The Wallace Line will come to exist solely as a line on the map, as a faint memory of the famous but forgotten naturalist after whom it is named. Amazonia and Nusantara, once known to Wallace through such careful, painstaking study, will come to resemble the lost continent of Atlantis and its mythical beings from a long gone era—beings such as the tiger and orangutan, the birdwing butterfly, and the flying frog. The mythical birds of paradise will have come full circle, becoming once again creatures of legend, as they had been before Wallace travelled to the farthest corners of the Archipelago to encounter their strange and singular beauty—only this time, they will be gone forever.

This essay is the revised and translated last chapter of the first German biography of Alfred Russel Wallace, written by Prof. Dr. Matthias Glaubrecht, entitled *Am Ende des Archipels: Alfred Russel Wallace* (Berlin: Verlag Galiani, 2103), 397–410. It was translated from German by Anna-Sophie Springer.

Written for a popular audience, the text contains no notes; see Editors' Notes below and "Further Reading" on the next page for relevant source material.

- 1 In 1858, while on an island in the western archipelago (historians are uncertain whether it happened on Ternate or Halmahera), Wallace had a sudden epiphany regarding the evolution of species by natural selection. He posted a detailed letter about it to Charles Lyell in order for him to pass it on to Darwin. At the time, Darwin had not yet published anything significant about his own theories on the subject and was horrified that someone else could now become known for it sooner. With the support of Joseph Hooker, another of Darwin's close friends, Lyell thus arranged a public reading of Wallace's paper alongside excerpts of Darwin's writing in a meeting at the Linnean Society of London on 1 July 1858 (see Fig. 05. page 79). Rather hastily, Darwin then published his book *On the Origin of Species* in November 1859 while Wallace continued to explore the Malay Archipelago until his return to England in 1862. Today, many biologists are troubled by the fact that in the popular history of biology Wallace did not receive equal credit as co-discoverer of the theory of evolution. To access Wallace's digitized letters, see <http://wallaceletters.info>.
- 2 Before Alfred Wegener developed the theory of continental drift in 1912, Wallace deduced that the islands east of Bali and Borneo within the Malay archipelago must have once been separated from the mainland Asian continent through a sea level rise caused by melting ice-age glaciers. Wherever the ocean was narrow but very deep—for example between Bali and Lombok, and between Borneo and Sulawesi—animal species were radically different. The discovery is remembered by the so-called "Wallace Line" running between these islands, marking the division between Asian fauna ("fauna orientalis") and Australian fauna ("fauna australis"). Furthermore, Wallace himself is considered the "father of biogeography" and the term *Wallacea* refers to the biogeographical area east of the Wallace Line, but west of New Guinea and Australia; see <https://en.wikipedia.org/wiki/Wallacea>.
- 3 Based on Old Javanese, *Nusantara* is the contemporary Indonesian term for the Indonesian archipelago.

Further Reading

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Deforested plot of land after logging, burning, and construction of drainage canals, Sumatra, circa 1900. Image from the exhibition *125,660 Specimens of Natural History*, Komunitas Salihara Gallery, Jakarta, 2015. Courtesy of the Indonesian Institute of Science.

Our Enemies Are in Power

Zenzi Suhadi (Z S) in conversation with Christina Leigh Geros (C G), Anna-Sophie Springer (A S) & Paulo Tavares (P T), translated by Alifa Rahmadia Putri & Widya Aulia Rahmadi

The city of Singapore, which Alfred Russel Wallace reached during the first of several visits in 1854, was founded only twenty-five years prior to his arrival by another Englishman, Sir Thomas Stamford Raffles (1781–1826). When the Dutch lost their Indonesian colony to the British during the Napoleonic Wars at the beginning of the nineteenth century, Raffles acted as governor of Java for a few years beginning in 1811. From 1818 until his departure for the island of Singapore, Raffles was then governor of Bengkulu in the southern region of West Sumatra. In Singapore, the legacy of the colonial administrator is commemorated by statues and the name of one of the city's most luxurious hotels; in Bengkulu, Raffles's namesake is given to a plant, which goes by the macabre colloquial nickname of "corpse flower." Endemic to the rainforests of this region, the *Rafflesia arnoldii* is the world's largest flower; as an insectivore, it exudes a revolting odor of rot to lure its prey. Anna-Sophie and Etienne were introduced to this flower for the first time in 2014, when they visited the area with Zenzi, a trained plant biologist and environmental activist normally based in Jakarta. Zenzi was born and grew up in a small village in the hilly forests just a few hours drive from the city of Bengkulu.

Since this first foray into the rainforest together, Zenzi—currently the Head of the Department of the Research, Advocacy, and Environmental Law of the non-governmental organization Wahana Lingkungan Hidup Indonesia (WALHI), the Indonesian division of Friends of the Earth—has been a generous and important interlocutor about the archipelago's environmental history, contemporary ecological challenges, and current forestry politics. In the summer of 2016, Anna-Sophie recorded two long interviews with Zenzi: the first conversation, conducted together with Dr. Paulo Tavares during his visit to Jakarta in preparation for Forensic Architecture's installation at the 3rd Istanbul Design Biennial—*Are We Human?*; and the second one shortly thereafter during a field research trip with Jakarta-based designer Christina Leigh Geros in South Bengkulu. While the *Rafflesia arnoldii* is now protected (and celebrated as one of Indonesia's three "national flowers"), large-scale monoculture plantations and mineral mining pits increasingly devour the biodiversity of tropical forests which naturally host this extraordinarily curious species. It is not alone in the struggle to survive among rapacious developments all over the island. In the edited version of our conversations with Zenzi that follows, he shares his perspective on the complicated political economic reality of Indonesia's rapid and all-too-often inequitable land-use transformation and the corpses this process has left in its wake.

A S

Let's start off with a brief introduction of you and your work.

Z S

I am a forest campaigner at WALHI's National Office. I joined the organization in 2004 for two reasons: first, I grew up in a village-turned-plantation and witnessed firsthand the devastating impact of large-scale oil palm monocultures. Second, I studied biology for my bachelor's degree, and I saw how many environmental impact assessment reports (AMDAL) carried out by my professors were fraudulent—they were modified to deceive the public. So my motivations at WALHI are to limit the damage of deforestation and to expose the lies produced by academics.

I invited you to visit the regency of South Bengkulu because it is a region within the province of Bengkulu where the forest is still in good condition compared to the other eight regencies and the city. Bengkulu's total area is 1.9 million hectares, with over fifty percent of the land as forest. With a total population of two million people, most residents live traditionally and procure their subsistence directly from the forest and small-scale, integrated farming. Unfortunately, out of 900,000 hectares of land that should have been accessible to the people, 560,000 hectares have already been conceded to private businesses for monoculture plantation agriculture and mineral resource mining. Hence, two million people are only able to share the remaining 340,000 hectares of land, with the result that for the most recent generation, on average individuals must subsist on only a quarter of a hectare of land.

A S

Besides monoculture acacia plantations, which are utilized for the pulp and paper

industry, the other monoculture currently transforming the Indonesian forests is the oil palm. The first oil palm plantation in Nustantara opened in Sumatra in 1911, when Indonesia was still a Dutch colony. But, as I understand it, these early plantations were not so important. In fact, during the Second World War, Indonesia was instead the number one global exporter of quinine, a malaria cure derived from the cinchona tree. More recently, Indonesian crude palm oil (CPO) exports have soared, especially since the early 2000s. Not least due to increasing global demands for all kinds of products, from household items to biodiesel, Indonesia has become the most productive CPO exporter worldwide. Can you tell us a little bit about how oil-palm monoculture plantations were introduced in relation to the recent history of Indonesia?

Z S

Kelapa sawit, the oil palm, or *Elaeis guineensis*, is not a native plant of Indonesia; it originates from West Africa. It was first introduced by the Dutch government in 1848. After Independence, the Indonesian government began to establish oil palm plantations on a large scale after it received a loan from the World Bank in the late 1970s. Back then, oil palm plantations were managed by a state-owned business called PT PN [Archipelago Plantation Company]. Where I'm from, in Bengkulu, it's called PT PN VII; this business started its operation in the mid-1980s with a scheme known as the "nucleus-plasma plantation."

The PIR [Perkebunan Inti Rakyat, or People's Nucleus Plantation] sounds good in theory because the land that is developed into a plantation is supposed to be divided between the company and the local village community.

In reality, this has been rather problematic as we're facing a heavy mixture of systematic ecosystem damage and prevailing land-grabbing practices. So someone who back then (or today) gave up his or her land for a commercial plantation is not guaranteed ownership over a portion of it, even after the land was cleared and the plantation was set up. The number of rural people who lose access to their land in this way—without ever receiving any kind of monetary compensation—is high, especially where I am from, but this process occurs in many of Indonesia's plantation areas. With the introduction of these businesses, conflicts over land ownership started and have persisted ever since. By 2010, this conflict reached its second generation.

Historically, it's also important to note that the forest has been a major source of revenue for the state and the economic elite of our country; the transformation of people's *sawahs* [rice fields], forest gardens, and other lands into commercial monoculture plantations was not always voluntary. If someone decided not to give up his or her land for a plantation, historically they were denounced as a state enemy, a traitor, or a member of PKI [Partai Komunis Indonesia/Communist Party of Indonesia]—a title that could jeopardize one's life during the *de facto* dictatorship of Soeharto from 1967 to 1998.

AS

Regarding the “nucleus-plasma” scheme, who is entitled to sell the nucleus plantation's harvests: the community who manages this section of the plantation?

ZS

Nucleus plantations are divided among the people by *kavling*

[a Bahasa Indonesian word derived from the Dutch *kaveling*, meaning “lot”]. Communities must work on their land and sell the subsequent fruit bunches (which the crude palm oil is derived from) to the company until they have repaid their loans for machinery, seedlings, fertilizer, etc. So, for a very long time, up to thirty percent of every month's harvesting income will be used to pay off these loans.

PT

You mentioned that oil palm plantations were introduced in the 1980s as a World Bank program, and that residents were forced to give up their land to avoid being called a rebel or a communist. Could you tell us a little bit more about this?

ZS

Being called a communist was a very serious accusation in Indonesia—you may have seen the anti-communism posters reappearing in Jakarta and across the countryside recently. During the Soeharto era, however, not only could you face extrajudicial arrest, the government could also restrict your access to facilities provided by the State. For example, if a person aspired to be a civil servant, his or her application and future career would be hampered because of such an accusation. Pressured in this way, a lot of people chose to give up their land. Many others refused to give up their land in the 1980s and they ended up being jailed.

PT

So there were many conflicts and violence in the twentieth century when this modern plantation economy was introduced here. What was the process and impacts for the people who resisted?

ZS

Back when the state-owned palm oil business entered my home region, the majority of the area was still forested, yet it nevertheless belonged to someone. At first, nobody was killed for resistance. But, in 2004, there was a person who refused to give up his land and he was shot at his farm. He was accused of stealing palm fruit from the company's plantation.

I am not sure about the statistics and numbers during the land seizures of the 1980s as I was still a child, but by 2010, when I was WALHI director in Bengkulu, I was already advocating for twenty or so people who demanded that their land be returned. The company replanted the area even though the whole initial cycle of twenty-eight years had passed and the land was supposed to be given back to the original owner. Even though only one person died, the impact affected the friends and families and a lot of people suffered from mental trauma. The parents of the killed farmer were traumatized after the event. And later, during a time when twenty people were captured in 2010 and kept in jail to stop them from reclaiming their land, the remaining farmland was quickly transformed into plantations.

AS

Would you explain the growth cycle of oil palm?

ZS

The common belief is that one oil palm tree is productive for about twenty years.¹ However, PT PN replanted theirs after twenty-eight years. Most plantations in Bengkulu were planted in the 1980s; replanting was scheduled for 2010. With the right treatment, an oil palm tree can be harvested twice a month (with an average of fifteen fruit bunches per year). A one-hectare

plantation produces close to four tons of annual yield, since the oil palm is the most productive oil plant. Crude palm oil is a natural resource with stocks traded on the international stock markets; the price per tonne is never stable, but since the fall of 2015 it's gone up from around 400 Euros per tonne to nearly 600 Euros.²

PT

Previously, you mentioned the recent conflicts, when you were still based in Bengkulu, and said you had to engage with the situation closely as you saw your home region being turned into an oil palm plantation. Do you think there is a relationship between the moment the palm oil business was introduced and the displacement and violence that people suffered? Also, what is the relationship between these events in the 1980s and decentralization in the late 1990s and early 2000s.

ZS

You can observe an increase in the income level for the local community, but this increase is not accompanied by any improvement of wealth or sense of *buen vivir*. After landowners had given up their land and turned into workers, ideally they would receive money, but at the same time they were obliged to pay for resources that used to be freely available from the natural environment.

We have identified several basic changes in the human-nature relationship that have resulted from this dynamic. First, as owners became workers they lost their flexibility and independence. They must now adjust their daily schedule to the company's working hours. Second, the sense of mutual aid among the communities has diminished. For example, when a person wants to hold a ceremony, in the past local people would gather the required materials collectively from

the forest. However, as they suddenly began to make money, they also had to pay for everything (which made most things more costly, too), forcing people to sell even more of their land. Third, heterogeneity was replaced by homogeneity. People used to live with and from the surrounding nature and could consume diverse foods, but as the environment was turned into monocultures with restricted access, local people have fewer nutritional choices and people believe that the limited range of foods, with a shortage of traditional plants, has also decreased life expectancy. Lastly, a lot of people lost their identity. They no longer own land and therefore have no legacy. To people who grew up in the village, the process of land grabbing on a large scale did not only cost them their clean and free water, but also the rights of unborn Indonesians to their land inheritance. Traditionally, if someone was born here, he or she has a right to own land in this country. Since the commercial plantation business has been introduced, spreading across seventeen provinces in Indonesia, babies born after 1990 are no longer born into a village. Instead, they are born into the *afdeling* [a Bahasa Indonesian word borrowed from the Dutch expression for “division” or “unit”]—a new zoning system designated by the oil palm sector.

The identity crisis has also changed the culture. As people’s lives are controlled by the company, person-to-person and village-to-village interactions lose their traditional import. This is problematic, especially since the changes came so rapidly: the next generation will grow up in a new order, but one that frequently gives way to chaos. That’s why you can see an increase in substance abuse and many sexual offenses; as traditions and cultural orientations are lost, people are

no longer held in place as they used to be in their village communities. In the 1990s, many youths whose parents had lost their land went to Jakarta to find jobs. Eventually, they come back to their hometown bringing Jakarta’s free culture. My father, a village elder and tribal leader, tried to restore the order during his eight-year leadership, but this did not last long after he stepped down. Economic development is not always the answer.

P T
I am trying to understand this history more clearly. Could you explain how, when oil palms were introduced, the land grabbing expanded in the areas?

Z S
This is all part of the paradox where earning money was not accompanied by wealth improvement. The introduction of large-scale oil palm plantations has triggered an unprecedented horizontal conflict among the people.

We had a customary law that used to regulate land tenure. If a person claimed tenure over a certain area by cultivating that land, people in the village would respect that. With regards to so-called *adat* communities, this would be *adat* land [*adat* = “ancient,” sometimes used like “Indigenous,” but often also in the sense of “traditional”]. However, as plantation companies entered the scene, they tried to take over the land using a positive law where nothing was admissible without proof. So, since people hardly ever had written proof of their land ownership, conflicts ensued and stretched over a long time. Common people lost in court because they did not have official land certificates.

In addition, horizontal conflicts arose due to a new land configuration which divided plantation land into lots. When a person gave his or her land

for such a plantation, there was no guarantee that they would be assigned to work on this stretch of land—everyone received a share based on the allotment, but that could be anywhere in the region. In other words, they might suddenly have to go work on their neighbor’s land.

P T
You mentioned earlier that, in Soeharto’s era, the government was very repressive. Do you think there was a relation between such repression and the expansion of the palm oil business in Indonesia?

Z S
The pattern of land grabbing in the Soeharto era is slightly different from how this has worked since 1998. But land grabbing is still a major problem that continues to involve palm oil companies today. Back in the days of Soeharto, the government was very authoritative and any resistance to their plans would easily lead one to prison. Since the *reformasi* that came with the end of the dictatorship, companies instead have tended to push for sectoral regulations that can protect or endorse their practices. For example, the recently introduced *Undang Undang Perkebunan* [Plantation Laws] and *Undang Undang Mineral dan Batu Bara* [Mining Laws] regulate land ownership and limit a community’s customary rights. These regulations were backed by companies to serve three functions: as a legitimization of illegal practices; as a way to expropriate people’s rights to enter and own land; and, as a means to expand privatized territory. In addition, private businesses use these laws as a way of avoiding responsibility.

P T
We heard there were massive fires in 1997 and again in 2015, as well as land grabbing, dispossession, and other forms of violence. Perhaps you could give us a sense of what this means on the ground right now?

Z S
During my tenure at WALHI, I have observed four developments that have all recently increased proportionally with one another: 1) permit issuance; 2) criminalization and conflict; 3) floods and landslides, and 4) large-scale fires. If in one year a lot of permits were issued, the year after there would be an increase in criminalization and conflict. This event would be followed by floods and/or fires in subsequent years. Usually, a spike in permit issuance starts during an election year, which could produce a sharp increase of up to 200 per cent.

A S
In your estimation, do small-scale swidden farmers, who habitually burn patches of land to clear it and prepare the soil for agriculture, have anything to do with the catastrophic fires that Paulo just mentioned?

Z S
Indonesian farmers have tenured in the peatlands for hundreds of years; traditionally, so rice could grow, farmers would only burn one hectare of land at a time during the monsoon (which does not match the haze timeline).³ It is necessary because peat is highly acidic and oxidizing the soil by burning the land makes it fertile for agriculture. But we are only seeing the very massive fires since the mid-1990s, which is when peatlands were first turned into concessions. The resulting haze is the result of uncontrolled—and largely uncontrollable—peat fires. Imagine that

the biggest pulp and paper company in Indonesia, for example, owns 300,000 hectares. In relation to its permanent employee numbers this means one worker must oversee almost 500 hectares of land. The government grants concessions for areas that are much too large to be effectively managed by a company—at least as long as it doesn't employ more people. In this way processes get out of control. Burning the especially carbon-rich peat soils of Sumatra and Kalimantan [Indonesian Borneo] emits what some have called a "carbon bomb" into the atmosphere that exceeds annual emission rates of Western industrial nations such as the United States or Germany. In 2015, the number of hotspots reached 100,000. During the enormous number of fires and toxic haze last year, people in Malaysia and Singapore lost their access to clean air; according to scientific estimations, around 100,000 premature deaths occurred in Indonesia as a result of this haze.⁴ It is also important to understand that environmental damage cannot be tied by administrative boundaries.

PT

Is there a connection between the forest fire incidents and the land grabs for plantations? How are these areas managed in relation to one another?

ZS

Indonesia classifies its territory into various land-use types. Among these, "forest" type areas are managed by the Ministry of Environment and Forestry (established by the Soeharto regime), while land classified as "horticulture" and "plantation culture"—or "cultivation" areas—is managed by the Ministry of Agriculture. Through the Forestry Law No. 41/1999, land that is classified as *hutan negara*, or "state

forest," is only accessible to the government, whereas a cultivation area can be accessed by anyone.⁵ A problem arises when an area is designated as a state forest while people are actually living on this land. There are hundreds of thousands of villages whose area overlaps with so-called state forest areas. Companies often use this land status to displace people from their homes, so, if people have refused to give up their rice fields for plantation, companies often lobby the government to convert the area into a state forest so they can then evict the people from these enclaves with charges of illegal logging, fishing, or farming. Once the residents are displaced, the status is changed back to a cultivation area and the company can get a permit to develop it into a plantation.

If we overlay the concession map with the fire hotspot locations from 2015, we can see that many hotspots were found outside of cultivation areas and in forest areas instead. These, however, are restricted access for local farmers. This reflects a situation that favors the commercial sector; so-called damaged forests are prioritized for conversion into cultivation areas.

Peatland normally works like a sponge, absorbing huge quantities of water. Peat forests grow on swampy ground, and it is only by being inundated with water that the soil can sequester such high levels of carbon. To make this land available for production, companies must first dig canals to drain the water out of the peat. As the land is desiccated, valuable trees are also logged, and the soil itself becomes increasingly flammable. After it is drained, logged, and burnt, these former peat forests are converted into plantations; besides oil palm trees, acacia trees are planted in huge quantities for the pulp and paper industry. These practices put an immense strain

on both the ecology and the local people inhabiting these regions.

AS

Among lay people, environmentalists, and policy makers, trees and forests are a longtime favorite in discussions about global warming because of their ability to sequester and store carbon. For decades, "planting trees" has been a poster strategy. But in the context of the gigantic industrial monoculture plantations as we encounter them in Indonesia, I am beginning to understand that the definition of which type of green cover may in fact count as "forest" becomes crucial. There are the old-growth, ecologically rich and symbiotic forests; then there are now systematically planted monoculture forests created for the purpose of international carbon offsetting schemes such as REDD and REDD+; and then there are also industrial tree plantations, including the oil palm plantation.⁶ Do you know of any cases where those categories have been blurred and an oil palm plantation is actually classified not as agriculture but as forest and thus made financially relevant in the carbon sector?

ZS

Classifying oil palm plantations as forest is a misleading idea and a wrong strategy because they produce more greenhouse gas emissions than natural forests—starting with the process of clearing the land and continuing through fertilizing, harvesting, and so on. Even though oil palms do grow faster than many other forest trees, the carbon released by establishing such a plantation can never be balanced out again with the carbon sequestered by the oil palm tree, not least because compared to other tree species it has the lowest sequestration potential. Sustainability criteria for oil palm plantations remain controversial;

proposals to include certain oil palm plantations in the REDD+ scheme, in my opinion, are only driven by greed for more money but cannot deliver any real justice regarding ecological or environmental struggles.

AS

In 2014, when you took Etienne and me to your home in Bengkulu, we went to a village that was struggling to protect their land against an oil palm company. Could you summarize the situation there?

ZS

There have been many incidents where people burned excavators or other heavy equipment that belong to a company. This was something they had learned from the government itself. They had the courage to burn these things because the government allowed companies to pressure and evict them. One of the cases in Bengkulu actually originates from a conflict leading back to the 1980s. A company obtained a license to plant cocoa, but instead only extracted the timber from the land. Later, it used the license over the land as a means for "land banking"—that is, when the land is invested to procure financial credit from a bank, but otherwise is not exploited through the means of agriculture or agroforestry. When the company CEO was charged with corruption, the license was expropriated and auctioned off by the government. The problem was that meanwhile tenure over the land had changed because the local people had started to use the land for their own agriculture. You see, land issues are very complicated in Indonesia. So when another company bought the license and wanted to operate commercially on the land, it turned out that people had already cultivated the land. The company then hired a bunch of *preman* [thugs],

backed by the police, to evict these people. When they reported their harassment to the local government but failed to receive any response, they started to burn the equipment.

A S

Villagers we spoke to emphatically said they were at “war.” Is that the language that people typically use to describe the situation?

Z S

Yes, that is still the case. Sometimes people get arrested; then there are usually two options: have all charges dropped but admit that a respective company is legitimately entitled to the land, or go to jail for a very long time.

P T

Is it a common practice to hire thugs to displace people in order to occupy their lands?

Z S

Yes, it is common to find this practice in relation to most palm oil companies operating in Indonesia; these are gangsters who are paid to commit violence, light fires to open up land for planting, and get local people arrested.

P T

If we also overlay a map of displacement onto your map relating fires and concessions, do you think we could also see a relationship between concession, fire, and displacement?

Z S

These three things are clearly related to each other. But, from the map I've shown you, we can only see the connection between fire and concession. Where a fire happened outside a concession, companies would start to plant on that land the following year. In the Sumatran province of Jambi, we

did gather evidence that the process of burning forests had been used as a tool to displace people. When fires reached local fields (which had never happened before), farmers lost their harvests and in turn had to sell their land in order to make up for the loss of income.

C G

Here, in the regency of South Bengkulu, what are the names of the companies that are trying to purchase or have purchased (more) forest land?

Z S

In South Bengkulu, we divide the companies into three categories:

Palm oil companies. The three companies with a hold over the land are PN, Agro Bengkulu Selatan (ABS), and Jatropha. PN's land has been given back to the local people. However, ABS and Jatropha have started the land clearing process.

Iron sand mining companies. This sector was stopped from 2009 to 2012 when operations in ten companies throughout the coastal area of South Bengkulu were frozen.

Gold mining companies. This sector is currently our first priority because it is acutely threatening. Barrick Gold Corporation, from Canada, owns concessions for almost 300,000 hectares of land along Bukit Barisan, which includes all the forest land where the headwaters of the rivers in South Bengkulu and Kaul are located. If Barrick Gold initiates their operations, all the remaining forest land will be gone and all the rivers will be destroyed.

A S

Can you describe the forests that we saw today? Were they primary forests? If so, could you explain why the trees nevertheless are relatively small? Has there been any selective logging happening here and, if so, since when?

Z S

If we are walking from Bengkulu towards South Sumatra, the forest on the left hand side is primary forest; on the right hand side, it is a *hutan adat* [traditional community forest] owned by local people (not by the state), which is usually used for small-scale plantations. The forest on the right-hand side looks different because it has been opened for coffee plantations and the big timbers have been used for house construction—this is why the trees are relatively small. In South Bengkulu, residential areas follow the course of the river and the roads, which also creates patterns for cultivation and extraction.

The condition of the forest will deteriorate further if the communal forest falls into the hands of commercial development because it would be opened entirely. On the contrary, if the forest stays within the control of local people, it will be much better protected because they will implement the local wisdom by planting shadowing trees that are higher and denser than coffee and thus maintain the natural environment.

A S

In the primary forest how many species of trees must one imagine?

Z S

I don't have the exact number of tree species. However, in my previous research about orchid taxonomy, I found 179 different species of natural orchids within 500,000 hectares of forest land. This indicates the richness of biodiversity in South Bengkulu.

A S

In our meeting this afternoon, I asked the Bupati [regent] what it would take to make the forest into a national park. He replied that it would be very difficult due to people's need for agriculture. This reminded me of the growing

recognition by many conservationists that complex forest ecosystems benefit from the presence of local communities, which are better able to support conservation practices than creating zoned-off parks where people are not allowed. What is your experience regarding the forest as a social space?

Z S

Yes, we agree with the Bupati. Your question also connects to the “state forest” / “cultivation” issues we've already talked about. Since the people are doing agroforestry, it is not necessary to change the land status into *hutan negara* [state forest]; rather, the combination of people and forest could create a territorial buffer zone against monocultures. Converting the land into a “conservation” area, on the other hand, would infringe on the rights of the people because the state would be severing the relationship between the people and the land. In a “conservation” area, people are usually not allowed to produce or harvest anything. In fact, the people's needs from the forest are quite diverse; besides sourcing timber, they also use it to collect organic medicines and many other non-timber forest products.

The idea of changing the land's status into a “conservation” area or national park mainly comes down to an issue of power. National park status means the land control falls under national power. But, we think such questions should be approached via regulations for management and production on the provincial or regional government and legislature level. The most important thing is that the process of protecting the environment should not harm the local people's rights to the land because one of the main goals of saving the environment is to protect the needs of the people and empower them in their role as stakeholders.

A S

I understand that the community argument is important for all of WALHI's environmental activism. But, through my fieldwork, I have come to believe that the separation between "good people," on the one hand, and "bad company," on the other, becomes tricky as soon as small-holders lose their access to traditional ways of life and are forced to adapt to (and often participate in) the conversion of the forest into monoculture plantations. As you've said, many people have no other choice than becoming plantation workers. And, what many people seem to want then is a piece of the pie, so to speak, of the wealth that palm oil promises; that is, they want their own productive oil palm plantation.

Can you describe some of the difficulties that you have encountered in your work with rural communities? I am wondering how difficult it might be to re-establish the forest stewardship practices we've just talked about when the land is being converted so quickly and so violently across vast areas of Sumatra, Kalimantan, and West Papua?

Z S

The most important lesson that WALHI learned from the last thirty-four years of working with communities throughout Indonesia has to do with people's loss of a sense of belonging and their diminished sense of responsibility towards the land once their right to the forest has been taken away. This structural undoing is commonly utilized by private and corporate players with an interest in gaining access to land. Indonesia has the world's third-largest tropical rainforest. Of the circa 190 million hectares of land that make up Indonesia, approximately half are forest land.⁷ However, the government's capacity to monitor the forest is very limited. For instance, between 2000

to 2012, the estimated destruction of forest land was six million hectares.⁸ Unfortunately, the government was only able to process a disproportionately small amount of hectares in forest-land claims in court. Hence, the act of protecting, managing, and utilizing the forest should prioritize local people as the main actor by allowing them to exercise their sense of belonging and responsibility. A lack of political will will always be an important factor as well. Even the most well-intentioned moratoriums do very little unless they are fully enforced on the ground. But, we also must work harder to enhance people's ecological understanding from the educational point of view. One example is river biodiversity. As we've seen earlier when rafting down the river, some people still use poison or electric shock for fishing because they don't know or care about the broader effects of these practices. Therefore, education—and legal education—remains both a huge factor and a huge challenge in all of this.

C G

It seems that your work has to happen on so many different levels. One is within the national government in Jakarta. Of course, you are also active at the local level, such as what you are doing here in Bengkulu, but I imagine throughout the archipelago, you have to get officials to see the value of other kinds of economies and the value of protecting the land for the people. In addition to all this, you have educational programs teaching communities about how to use the land more carefully in order to increase biodiversity and to understand how different plants can be used. This creates a sense of ownership so that people realize that the land is theirs, and it becomes their privilege and pride to take care of it. What kind of overall

strategy does WALHI have for addressing all of these different levels?

Z S

We have always developed our strategies based on pilot projects because we soon realized that we have a big spirit with limited resources. We pick one focus area to start a pilot project in one of the areas you've described, ranging from management to advocacy to education. If a strategy proves successful, we later implement it in other places. One example, from Bengkulu, comes from when we tried to stop the iron sand mining in the region. We first organized against one company in a village called Kampung Penago. Successively, we confronted nine other iron sand mines, always one at a time. When one company had been shut down, we moved on to another company, and so on. So in the end, we were able to close down all of the iron sand mines along the coastal area of Bengkulu province.

Regarding the regulation of the management system, one example is the model developed in Meranti, Riau province. The people were able to adapt to the peatland ecosystem in such a way that they no longer need to apply the use of fire: by cultivating sago palms. Then, in 2014, we invited the current President Jokowi Widodo to go there with us so he would implement our model on all levels of the government system.⁹ Nevertheless, taking care of Indonesia cannot depend on a federal approach, it has to start from the countryside; but, we also benefit from international pressure on transnational mega-corporations and financial institutions funding what is going on here.¹⁰

A S

Earlier, you referred to Forestry Law No. 41/1999. In the Indonesian weekly magazine *Tempo*, I read about a change

which the Aliansi Masyarakat Adat Nusantara [AMAN—the Indigenous Peoples' Alliance of the Archipelago] achieved at the Constitutional Court.

If I understand this correctly, one central phrase in a paragraph of this law was changed from "customary forests are state forests with customary laws" to "customary forests are forests with customary laws" [editor's emphasis]. The new definition seems to be more open to the needs of *adat* communities; as you've explained previously, the designation of state forest actually criminalizes people who access these areas. So there seems to be an increase in rights to the land and its resources. But, by dropping the word "state," the definition also seems to have been opened up to such forest areas that the state might have already given away, commercially, for instance, through a concession. Will this change be helpful, then, in disputes about the recognition of customary land rights, or will it simply increase disputes without much practical effect? I'd also like to ask if you can explain why in the Indonesian Constitution and legal system the consideration of land tenure rights remains so fuzzy?

Z S

If we reflect on the history of law and regulation development, you will see that the state has ignored land rights of Indigenous communities since the Dutch colonial era. Already, the colonial government wanted access to the land for the exploitation of natural resources and commercial agriculture. Even our contemporary Constitution purposely ignores the Indigenous peoples' presence and identity. I've identified four ways, which create land tenure conflicts between local small-scale stakeholders and large-scale commercial value extraction:

- 1) exploration of natural resources located above ground (logging and monoculture plantations);
- 2) exploration of minerals located underground (gold, iron sand, nickel, coal, etc);
- 3) land banking;
- 4) green grading (when land is zoned in the name of environmental service functions such as the carbon-trading business, but also in some eco-tourism and conservation contexts).

In addition to the Forestry Law No. 41/1999, there is also the law MK35/2012, which was issued also by the Constitutional Court [Mahkamah Konstitusi or MK]. It says, "customary forest is not state forest." It is a declaration from the state to acknowledge the forest owned by *adat*, or Indigenous peoples. However, the definition of who are to be considered Indigenous peoples (and where they are located) has not been clarified. As a result, MK35 cannot be directly implemented.

A constitutional bill should be enforced through the implementation of government decrees known as PP, which stands for Peraturan Pemerintah. PPs should regulate the mechanisms to formally recognize Indigenous peoples and their territorial location. But the government is reluctant to recognize customary land rights because Indonesia's *Kawasan Hutan* ["forest zone"] is so crucial for the generation of wealth and power. So these laws are unclear, inconsistent, and incomplete. Under the given circumstances, laws such as MK35 can even be played with horizontally, among communities themselves, because the customary land tenure system of *adat* peoples varies greatly across the Archipelago's different regions and islands. For example, in Maluku or Kalimantan, a tribal leader

is often still considered a Sultan. If we refer to MK35, the land is owned by the Sultan and his offspring, not the community. This condition will allow a Sultan and his offspring to set a claim on the land and sell it to private businesses for their own profit. Such cases have happened frequently in Kalimantan. Therefore, the law of this country still does not sufficiently formalize and secure the status of *adat* lands and *adat* customary land rights.

One could say that, since Independence, Indonesia's Constitution has gone through several amendment processes, which mainly served to protect the exploitation of natural resources by the state and private businesses with close ties to the political class. This is a problem and major challenge with effects for both the nonhuman environment and the human population. Here, Indigenous peoples and other forest communities are among the most marginalized social groups.¹¹

CG

You were saying to me earlier that you are now beginning to focus more towards Eastern Indonesia because of the different land use development stages compared to Sumatra and Kalimantan. Can you explain the recent situation and some of the changes you've been witnessing in Maluku and Papua and talk a little bit about the work you've been doing there?

ZS

Actually, I am not only interested in those regions because land-use extraction in Sumatra and Kalimantan is so much more advanced. In fact, the exploitation of natural resources in Sumatra and Kalimantan has been massive, with devastating environmental effects, and there will be more of this type of expansion towards the



Measuring a specimen of *Amorphophallus titanum*, another giant flower endemic to Sumatra, Buitenzorg Botanical Garden, Bogor, Java, circa 1900. Image from the exhibition *125,660 Specimens of Natural History*, Komunitas Salihara Gallery, Jakarta, 2015. Courtesy of the Indonesian Institute of Science.

Eastern regions of Indonesia. We focus on the advocacy model to shield the land from such destruction. Eastern Indonesia's ecosystems have more savannah, small islands, and large regions of wetland. So the landscape is very different from Western Indonesia, whose islands are very large and where peatland only exists in Sumatra and Kalimantan. In Eastern Indonesia, small changes will lead to significant consequences; this will harm people, flora, and fauna because small, more adapted ecosystems have stronger dependencies. For example, if the forest on a small island is turned into an oil palm plantation the fresh water will be drained very quickly. In Sulawesi, the wetland areas play a vital role; all the fish come from there. Once such an ecosystem is changed, people will suffer from the fish shortage for their daily consumption.

A S

As an activist working in the field, what is your intuition, your outlook, at this moment in the struggle?

Z S

If I were a pessimist I would have hung myself a long time ago. We realize that our enemies are in power and have the ability to change everything, including laws, to their will. The future in this

country for our children cannot just rest on the Constitution. For instance, there are many children born and raised in the megacity of Jakarta who have never experienced and enjoyed the beautiful nature across Indonesia. If our generation is not working hard to save the natural environment, it means that we will lose the battle against the profit maximization of a handful of super rich people. In addition, we would also be complicit in the future generation's loss of Indonesia's rich and beautiful natural environment. No one decides to be born in Indonesia. It is all contingency. Therefore, I am neither an optimist nor a pessimist; I am talking about our responsibility to the future generations. Even if we lose the fight, our effort will still help the next generation by not having to start from zero. But, if we win, the next generation will not face the same conditions as we are seeing right now. In fact, we have been successful in several cases, including in court, and our struggle continues.

- 1 The oil palms has an average production life-span of about thirty years, but it is easier to harvest the fruit bunches before the plant reaches two decades in age when it will grow much taller and productivity will decrease.
 - 2 See <http://www.finanzen.net/rohstoffe/Palmoelpreis/euro>.
 - 3 In contrast to clearing land for commercial plantations, small-scale swiddens don't rely on any drainage canals in order to dry out the peatland. Instead, only the top layer of peat is scorched by a farmer, whereas drained peatland becomes highly flammable also in the lower soil levels that can be several meters deep. Underground fires are one of the reasons why it has been so difficult to put off the raging dry season fires. Swidden farming by a community, on the other hand, can be beneficial for certain plants whose seeds need to be exposed to fire for them to split open, germinate, and grow.
 - 4 Kopitz, et al., "Public Health Impacts of the Severe Haze in Equatorial Asia in September–October 2015: Demonstration of a New Framework for Informing Fire Management Strategies to Reduce Downwind Smoke Exposure" *Environmental Research Letters* 11, no. 9 (2016), <http://iopscience.iop.org/article/10.1088/1748-9326/11/9/094023>
 - 5 Forestry Law No. 41/1999, http://theredddesk.org/sites/default/files/uu41_99_en.pdf.
 - 6 REDD stands for "Reducing Emissions from Deforestation and Forest Degradation and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries." It is a mechanism that has been under negotiation by the United Nations Framework Convention on Climate Change (UNFCCC) since 2005, with the objective of mitigating climate change through reducing net emissions of greenhouse gases and enhanced forest management in developing countries.
- As a mechanism under the multi-lateral climate change agreement, REDD+ is essentially a vehicle to financially reward developing countries for their verified efforts to reduce emissions and enhance removals of greenhouse gases through a variety of forest management options. See https://en.wikipedia.org/wiki/Reducing_emissions_from_deforestation_and_forest_degradation#Main_elements_of_REDD.2B.
- 7 Emily Matthews, ed., *The State of the Forests: Indonesia* (Bogor: Forest Watch Indonesia, 2002), http://pdf.wri.org/indoforest_full.pdf; for more recent statistics, see *State of the World's Forests: 2011* (Rome: Food and Agriculture Organization of the United Nations, 2011), <http://www.fao.org/docrep/013/i2000e/i2000e01.pdf>.
 - 8 Belinda Arunarwati Margono et al., "Primary Forest Cover Loss in Indonesia over 2000–2012," *Nature Climate Change* 4 (2014): 730–35, <http://www.nature.com/nclimate/journal/v4/n8/full/nclimate2277.html>.
 - 9 Jeff Conant, "Indonesia's New President Takes Key Step in Protecting Rain Forests from Palm Oil Plantations" Friends of the Earth blog, 3 December 2014, <http://www.foe.org/news/archives/2014-12-indonesia-pres-takes-key-step-protecting-forests>.
 - 10 Christine Spolar et al. "The Great Land Rush—Indonesia: Saving the Earth," *Financial Times*, "Investigations," March 2016, <https://www.ig.ft.com/sites/land-rush-investment/indonesia>.
 - 11 For a comprehensive perspective of the complicated legal status of Indigenous land tenure, see Sandra Moniaga, "Fighting over the Land and Forest," *Inside Indonesia*, 18 October 2009, <http://www.insideindonesia.org/fighting-over-the-land-and-forest>.

The Lepidopters: The Darwin Proboscis (2013–16)

Drawings by Iwank Celenk
Text by Mark von Schlegell

The Lepidopters is a five-mandible graphic novel produced by SLAVE PIANOS, scripted by Mark von Schlegell (Semiotext(e)), and drawn and water-colored by “Iwank Celenk” Erwan Hersi Susanto (Yellow Teeth Comics) from 2013 to 2016. A single run of a limited edition of each issue was published locally in Indonesia.

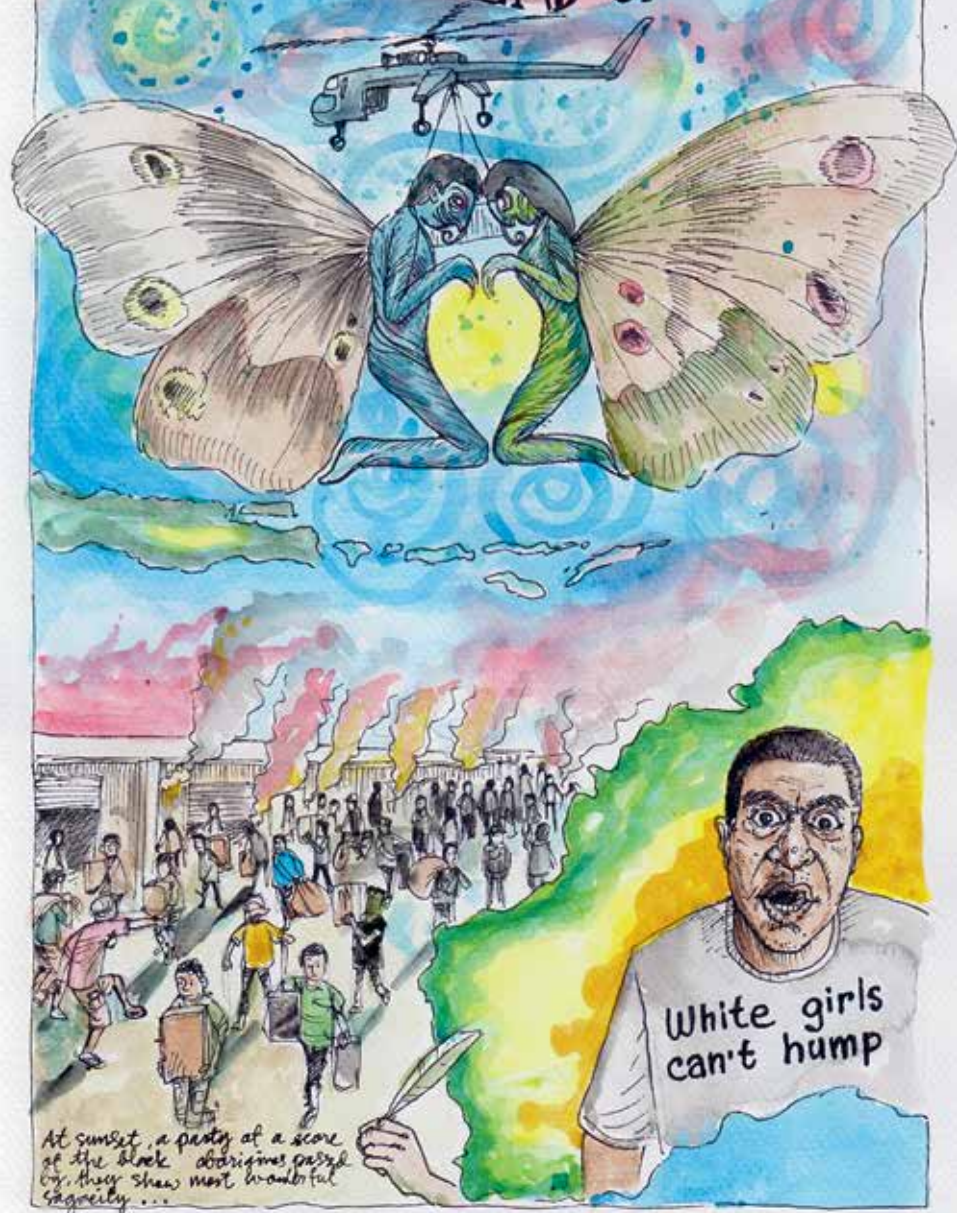
The comic nominally tells the story of an invasion of the Indonesian archipelago by alien moths, who plan to redefine Earth by engaging in inter-species reproduction. Here in *Mandible 4* they attempt to decolonize Australia.

From the comic, SLAVE PIANOS, in collaboration with the multidisciplinary Yogyakarta art collective Punksila, produced *The Lepidopters: A Science-Fiction Space-Opera*, a multivalent work for choir, virtuoso keyboard player, just-intonation mystic-punk band, automated gamelan, flute, clarinet, electric guitar, organ, percussion, electronics, and video that toured Indonesia and Australia from 2014 to 2016.

Mandible 4 is reproduced courtesy of the artists.

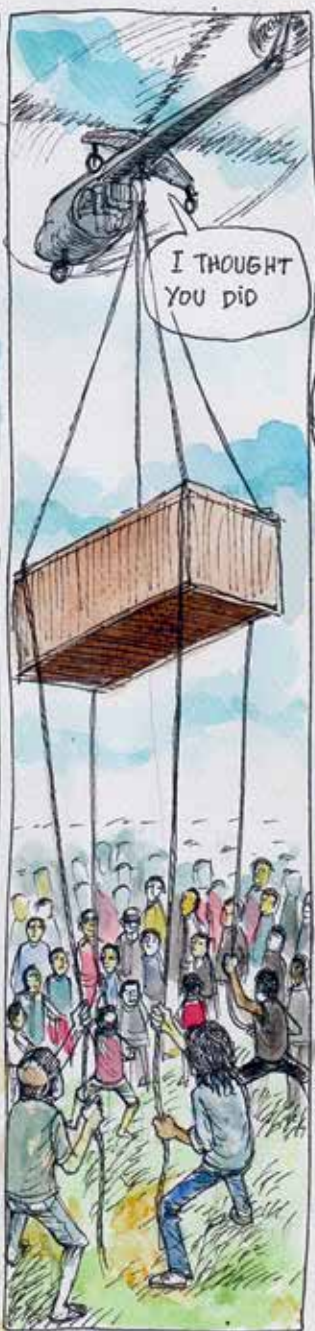
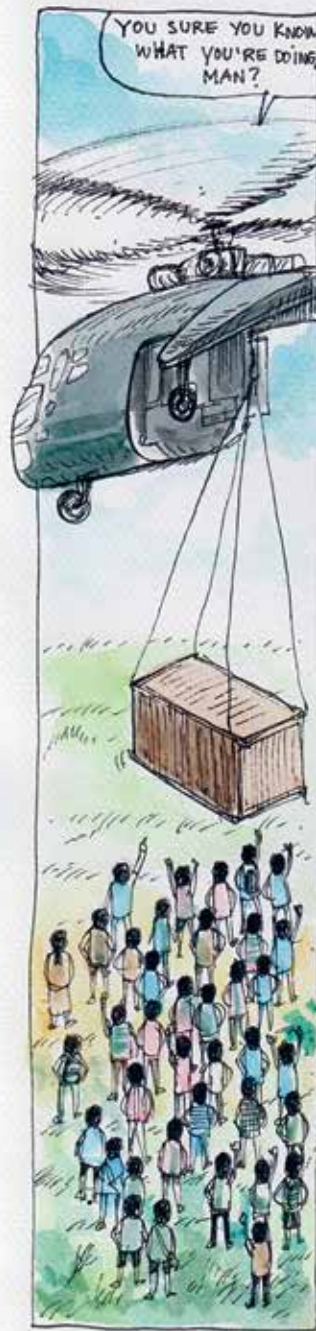
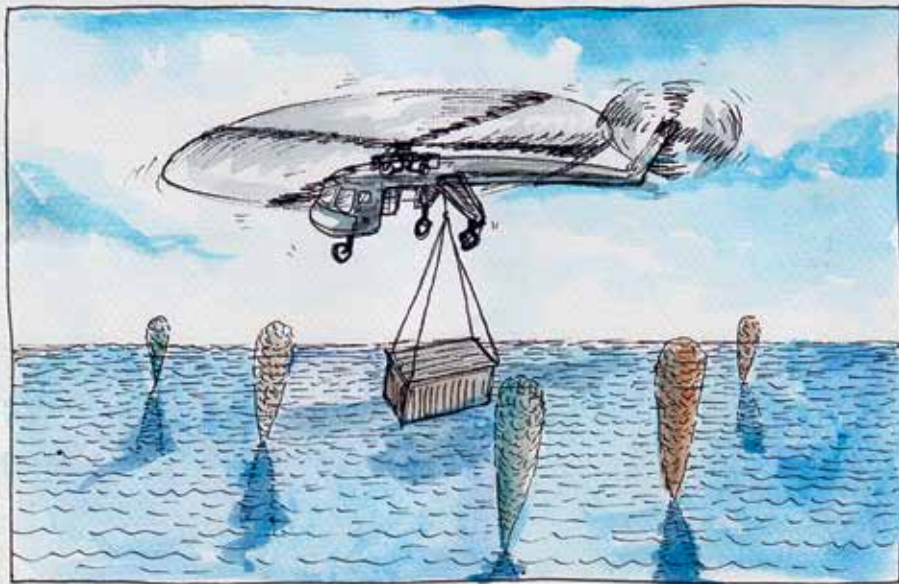
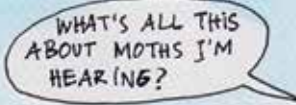
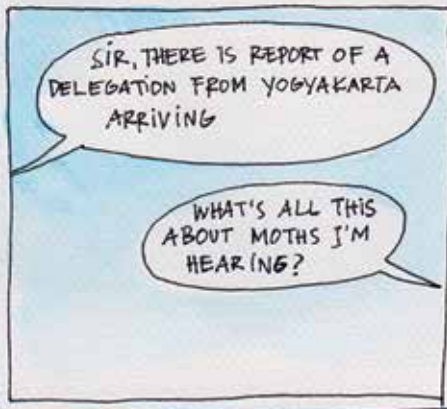


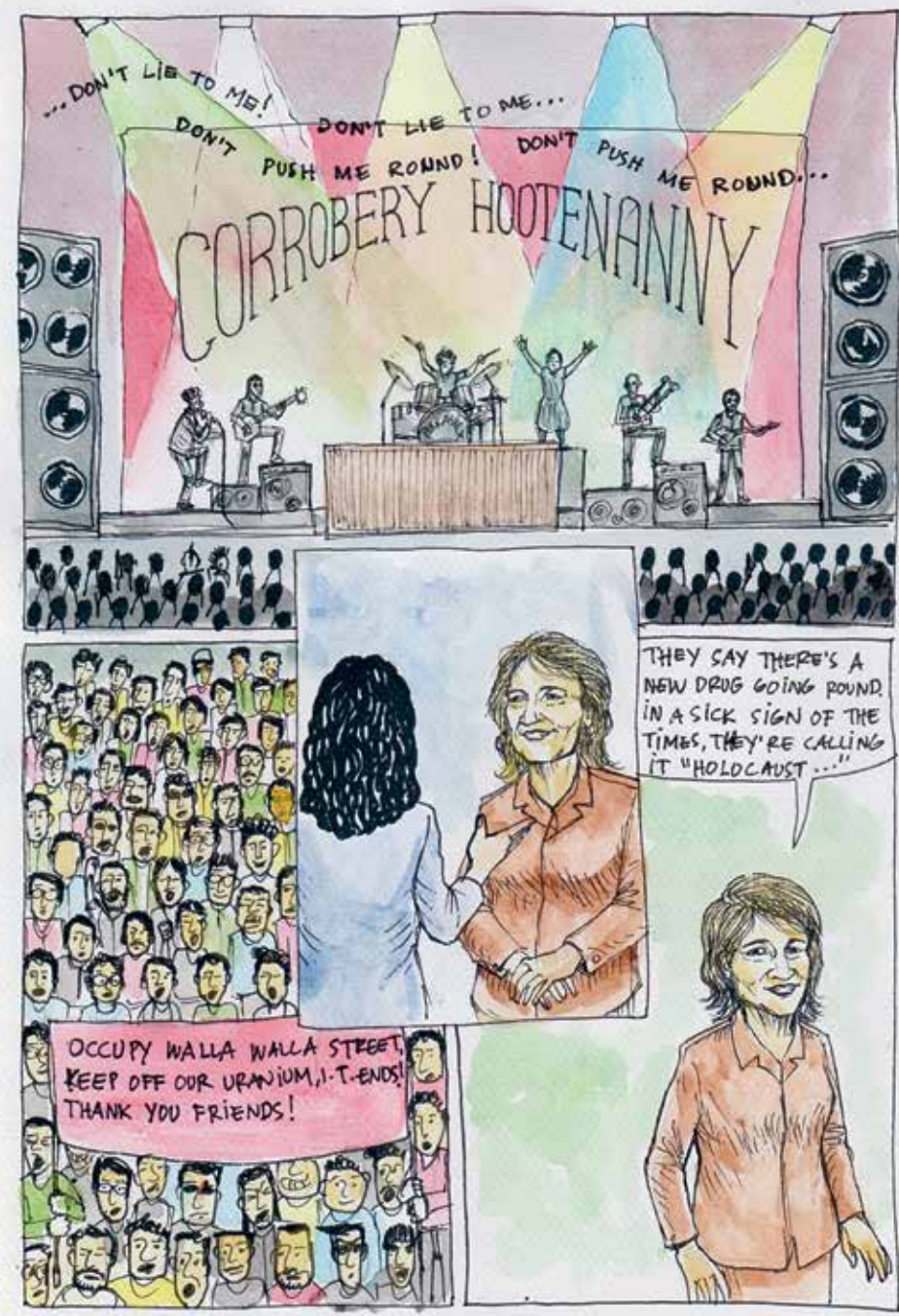
ONE DAY AFTER THE END OF THE WORLD

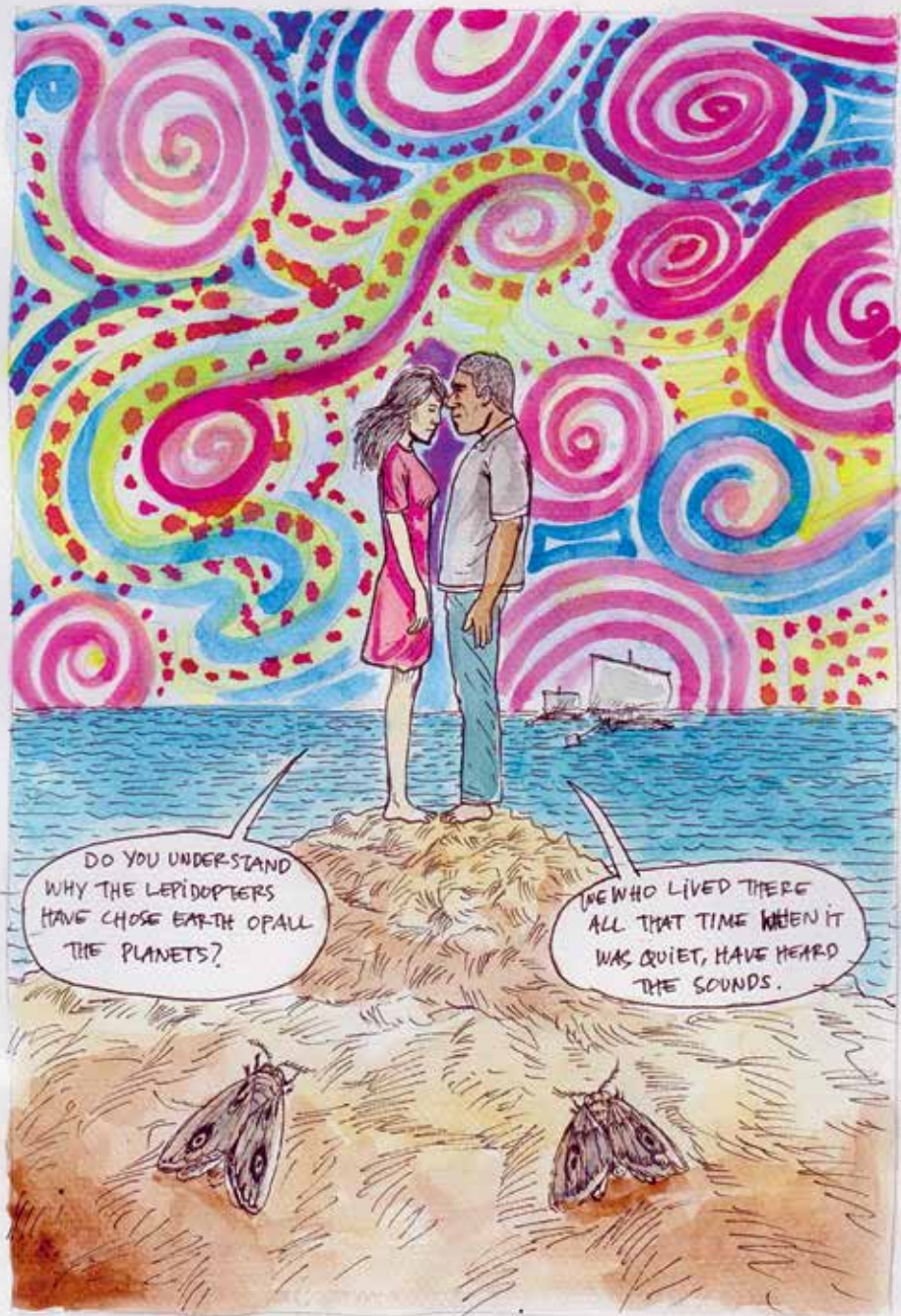


AT THE POINT LEE PROTESTS THEY SAY THEY'RE NOT MISSING THE INTERNET AT ALL...



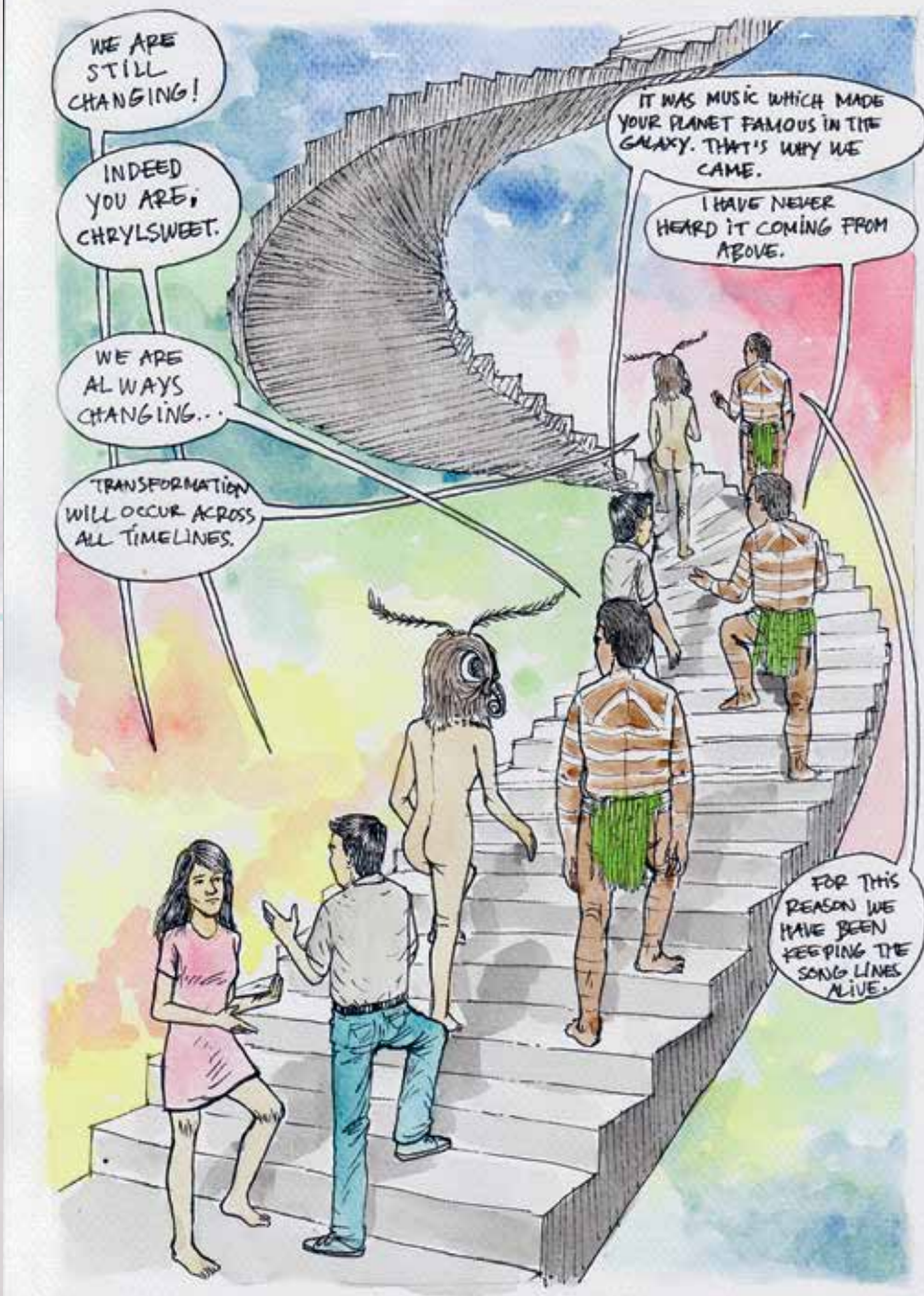






DO YOU UNDERSTAND WHY THE LEPIDOPTERS HAVE CHOSE EARTH OP ALL THE PLANETS?

WE WHO LIVED THERE ALL THAT TIME WHEN IT WAS QUIET, HAVE HEARD THE SOUNDS.



WE ARE STILL CHANGING!

INDEED YOU ARE, CHRYSWEET.

WE ARE ALWAYS CHANGING...

TRANSFORMATION WILL OCCUR ACROSS ALL TIMELINES.

IT WAS MUSIC WHICH MADE YOUR PLANET FAMOUS IN THE GALAXY. THAT'S WHY WE CAME.

I HAVE NEVER HEARD IT COMING FROM ABOVE.

FOR THIS REASON WE HAVE BEEN KEEPING THE SONG LINES ALIVE.

THE MOTH WILL HEAR YOUR DEMANDS.

NO BURNING OF FUEL.

NO SPEAKING TO ANYTHING OR PERSON NOT IN YOUR PRESENCE (UP TO 1000 METER.)

OR IF THERE IS A CHANCE FOR LOVE.

CHEW EACH BITE OF FOOD 50 TIMES.

BREATHE THROUGH YOUR HORN UNLESS YOU'RE WOUNDED.

NO OWNERSHIP OF LAND OR TERRESTRIAL RESOURCE.

ELECTRICITY ONLY FOR SONG STRENGTH.

ALL WHEELS MUST BE APPROVED.



THE PEOPLE WILL HEAR YOURS.

EXCEPT FOR WARMTH IN WINTER, WE MAY BURN WHAT IS NEAR.

NO ARCHITECTURE.

NATURALLY.

IF YOU CAN'T SMELL IT YOU CANNOT SEE.

THERE WILL BE NO TALK OF "SORRY"

NO TRAVEL BUT BY WIND, WATER, OR WALKABOUT.

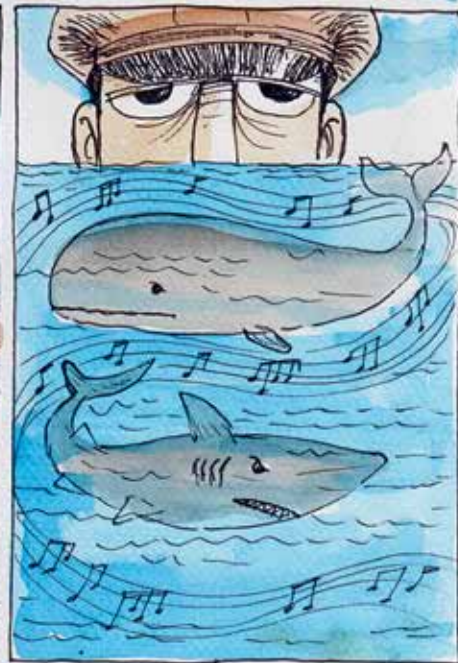
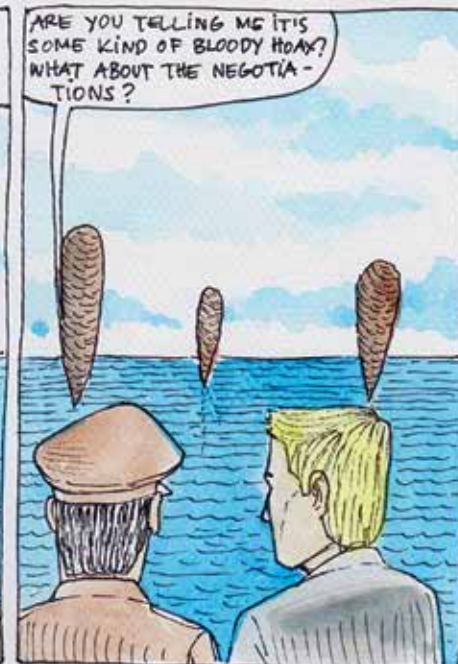
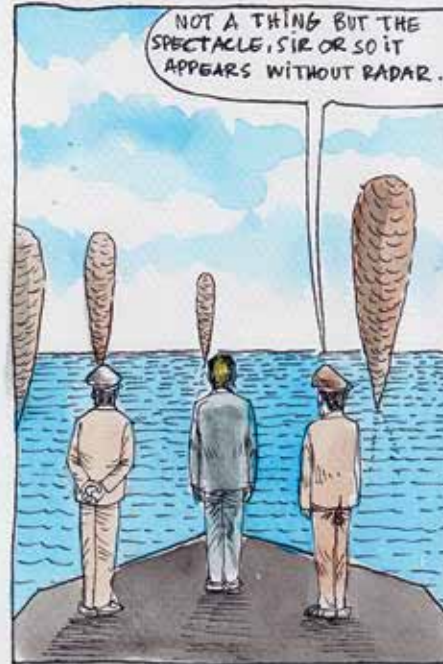
NOTHING MORE THAN YOU CAN CARRY TO OWN.

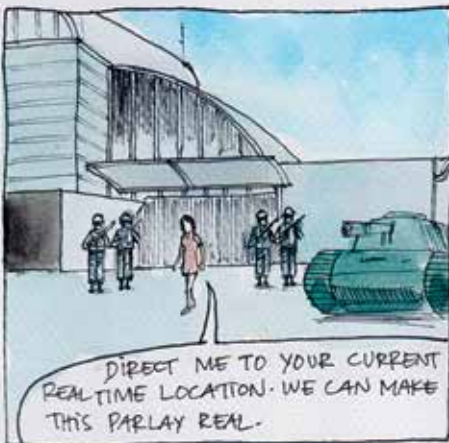
THREE-DAY WORKING WEEK.

APPROVED IN ALL PARTICULARS?

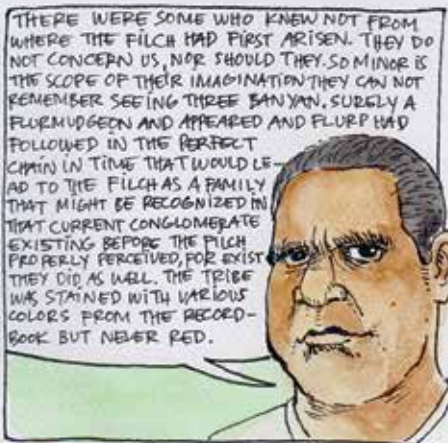
WAR ONLY WHEN NAKED.

LANGUAGE ONLY IN SONG

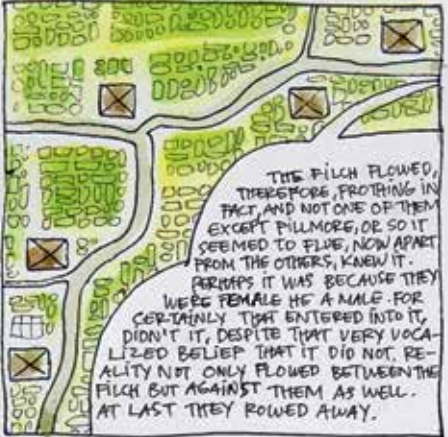




DIRECT ME TO YOUR CURRENT REAL TIME LOCATION. WE CAN MAKE THIS PARLAY REAL.



THERE WERE SOME WHO KNEW NOT FROM WHERE THE FILCH HAD FIRST ARISEN. THEY DO NOT CONCERN US, NOR SHOULD THEY. SO MINOR IS THE SCOPE OF THEIR IMAGINATION THEY CAN NOT REMEMBER SEEING THREE BANXYAN, SUBELY A FLUMUGGEDN AND APPEARED AND FLURP HAD FOLLOWED IN THE PERFECT CHAIN IN TIME THAT WOULD LEAD TO THE FILCH AS A FAMILY THAT MIGHT BE RECOGNIZED IN THAT CURRENT CONGLOMERATE EXISTING BEFORE THE FILCH PROPERLY PERCEIVED, FOR EXIST THEY DID AS WELL. THE TRIBE WAS STAINED WITH VARIOUS COLORS FROM THE RECORD-BOOK BUT NEVER RED.



THE FILCH FLOWED, THEREFORE, FROTHING IN FACT AND NOT ONE OF THEM EXCEPT PILLMORE, OR SO IT SEEMED TO FLUE, NOW APART FROM THE OTHERS, KNEW IT. PERHAPS IT WAS BECAUSE THEY WERE FEMALE HE A MALE. FOR CERTAINLY THAT ENTERED INTO IT, DIDN'T IT, DESPITE THAT VERY VOCALIZED BELIEF THAT IT DID NOT, REALITY NOT ONLY FLOWED BETWEEN THE FILCH BUT AGAINST THEM AS WELL. AT LAST THEY ROWED AWAY.



HOLOCAUST? REEFER?



THE FILCH WERE FIVE-FINGERED, MUCH LIKE THE FRYNILLIN



FILLMORE WAS MALE. THERE HAD NOT BEEN ONE MOMENT WHERE HE HAD ACTED HONESTLY NOR WITHOUT CONFUSED MOTIVE IN ALL THE STRAIGHT TIME. IN RETROSPECT HE HAD TO ASK HIMSELF IF INDEED HE WAS STRAIGHT AT ALL? RECKON HE THE MONSTER? FILLMORE? THE MONSTER WAITING TO DEVOUR HIS BROTHER'S FLESH? SO CONSTANT HAD BEEN THE STREAM OF LIFE AGAINST HIS FREEDOM THAT IT HAD ALWAYS EVER BEEN ALL THE ^{STAY AHEAD}

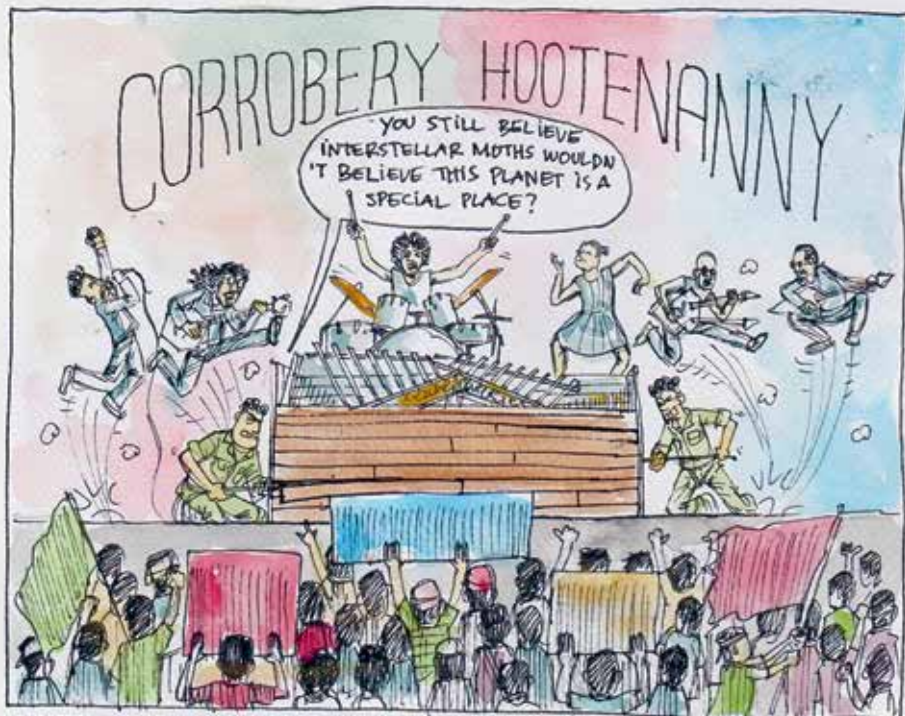
PLATES OF MEAT, FROG AND TOAD, AFTER DARK



SOMEHOW THE FILCH, THOSE HE CAME INTO CONTACT WITH, DIDN'T HAVE THE PROBLEM. THEY FLOATED OR APPEARED TO THOUGH CRACKS APPEARED IN ALL THE EDIPICES NOW DETERIORATING AND THEIR LIVES DIVIDED CHANGED IN TOTAL FREEDDOM. THEY MOVED FAR BEYOND THE TRUNK OF THE FILCH FROM WHICH THEY ALL FINGERED AS THEY ALL KNEW SO...



ALL PARTICULARS APPROVED.



NO CAPTAIN, I DO NOT BELIEVE THERE WAS ANY SPECIAL MIRACLE INVOLVED IN MY RECOVERY. DOUBTLESS I WILL VOMIT AGAIN.

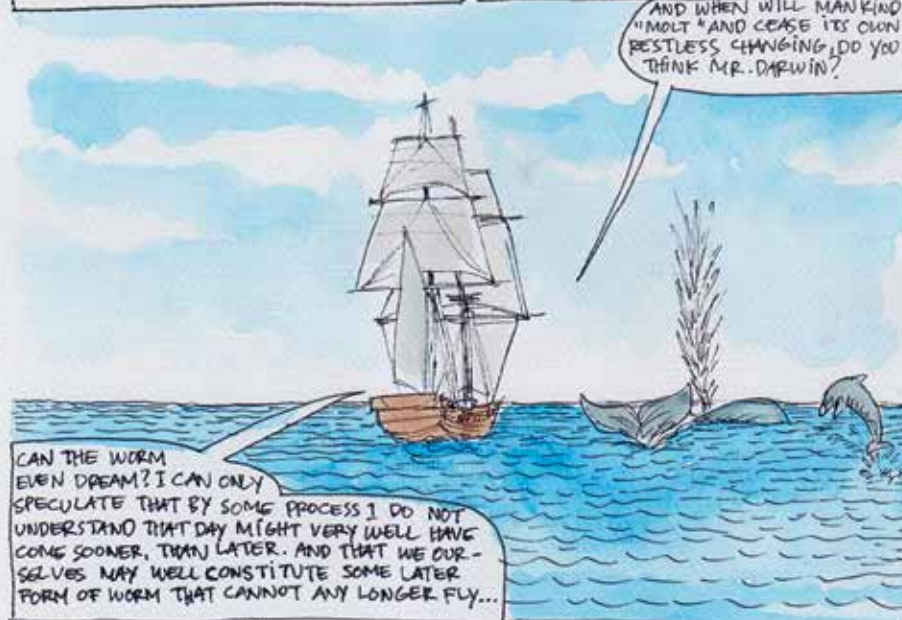


14 March, 1836. After several tedious delays from clouded weather, we gladly stood out at King George's Sound.

BUT SEE THIS MOTH. I HAVE MADE A FRIEND OF THE THING. ONE WING IS BLACK AND ONE IS WHITE. LOOK HERE FOR YOUR MIRACLE. THIS MOTH WILL NOT CHANGE. IT IS PERFECT. ONLY THE CATERPILLAR CHANGES: IN DEED IT CHANGES EVERY DAY FROM LARVA TO PUPA.



It appears on this continent some second creator was at work.



FAREWELL AUSTRALIA! I SHALL NEVER AGAIN SEE YOUR SHORES...



15



1



6

Three types of coffee beans arranged for comparison, Buitenzorg Botanical Garden, Bogor, Java, circa 1900. Image from the exhibition *125,660 Specimens of Natural History*, Komunitas Salihara Gallery, Jakarta, 2015. Courtesy of the Indonesian Institute of Science.

Contributors

GEORGE BECCALONI is a zoologist, evolutionary biologist, and historian of science who worked at London's Natural History Museum (NHM) as an entomologist for more than twenty years. He is currently the Director of the Wallace Correspondence Project, which he founded in 2010. He has studied Wallace's life and work for over sixteen years and is a co-executor of Wallace's Literary Estate, which owns the copyright of his unpublished writings. In 1999, Dr. Beccaloni set up the Wallace Memorial Fund, which restored Wallace's grave in Dorset and funded several memorials to him, including a large bronze statue now in the NHM. In 2002, he played a key role in helping the NHM acquire the world's largest and most important collection of Wallace's manuscripts, books, and other items from Wallace's descendants. He has published a number of articles about Wallace and co-edited the book *Natural Selection and Beyond: The Intellectual Legacy of Alfred Russel Wallace* (Oxford University Press, 2008). He was also a scientific consultant for the video *The Making of a Theory: Darwin, Wallace, and Natural Selection*, one of two narrators of *The Animated Life of A.R. Wallace*, and the historical consultant for the multi-award-winning two-part BBC series *Bill Bailey's Jungle Hero* (2013).

LUCY DAVIS is an artist, writer, and Associate Professor. She lived for twenty-eight years in Singapore, teaching at the School of Art Design & Media, Nanyang Technological University from 2005–16 where she founded the Migrant Ecologies Project. Her practice encircles animal and plant studies, natural histories, materiality,

and memory in Southeast Asia. Exhibition venues include the Taiwan International Video Art Exhibition, M1 Singapore Fringe, National University of Singapore Museum, Singapore Art Museum, National Museum of Singapore, Royal Botanic Gardens Edinburgh Art/Science Festival UK, the International Symposium on Electronic Arts (ISEA), and the National Gallery of Singapore. Her animated short *Jalan Jati (Teak Road)* toured widely and was awarded a Promotion Award at Oberhausen ISFF (2012), two Singapore Short Film Awards (2013), and Jury Mention for Technical Achievement, ISFF, Iran (2015). Migrant Ecologies were nominated for the Signature Asia Pacific Art Prize, Singapore Art Museum (2011) and were finalists for the Prix COAL France (2011). Davis is Southeast Asia Contributor for *ANTENNAE, The Journal of Nature in Visual Culture* (UK). She has written for: *Why Look at Plants?*, *Considering Animals*, *The DOCUMENTA #12 READER*, *BROADSHEET Art & Culture*, *Art AsiaPacific*, *Inter-Asia Cultural Studies*, and *NU The Nordic Art Review*. Davis was founding editor of the publication series *FOCAS Forum on Contemporary Art & Society* from 2000–07.

FRED LANGFORD EDWARDS is a visual artist living in North Wales, UK, with over twenty years experience in interdisciplinary work and collaboration with museums, scientific, pharmaceutical and educational institutions, creating contemporary works of art that draw on broad cultural histories and disciplines. With these works, Edwards is interested in exploring and making reference to academic, reserve, and private collections, which are rarely seen by the general public, as hidden archives of the history of science and ideas. More recently, he has worked in

the field investigating medicinal plants and related flora in the equatorial rain and cloud forests of Napo Province, Ecuador, and on the contributions of the British naturalist Alfred Russel Wallace to contemporary scientific thought. In 2015, his large-format photographic prints of Wallace's specimens were a major highlight of the exhibition *125,660 Specimens of Natural History*, Komunitas Salihara, Jakarta.

CHRISTINA LEIGH GEROS is an architect, landscape architect, and urban designer currently conducting and designing research about the intricate relationships between urbanism, ecology, and politics. Based in Jakarta, she is the Design Director of an exact office and the Design Research Strategist with the MIT Urban Risk Lab's PetaBencana.id field team in Indonesia. She is also a co-founder and co-investigator in the multidisciplinary collaborative SHO—a design practice working across a variety of scales, materials, technologies, processes, and mediums. Focusing on urban and ecological issues in Indonesia, Geros's work as a Fulbright National Geographic Digital Storytelling Fellow has used written, photographic, and videographic methodologies to communicate complex urban issues to a global public audience. Having been awarded several other research fellowships and design competitions—including the Penny White Prize at Harvard University's Graduate School of Design, the Rajawali Research Grant from Harvard University's Kennedy School Indonesia Program, and Harvard University's Radcliffe Institute Public Art Competition—Geros aims to merge design and research practices through multi-media publications, exhibitions, and spatial installations.

MATTHIAS GLAUBRECHT is the founding Scientific Director of the Centrum für Naturkunde, Universität Hamburg, where he also holds a full professorship in Faunal Biodiversity. Between 1997 and 2014 he worked as an evolutionary biologist and historian of science at the Museum für Naturkunde Berlin, where he was also a curator of mollusks. From 2006–09, he directed the museum's new department of museological research and was a member of the board of directors. In 2009 he was one of the main curators of the exhibition *Darwins Reise zur Erkenntnis*. Since 2008 he has been an elected member in the Zoology department of the German Research Foundation (DFG). Until fall 2014, Prof. Dr. Glaubrecht taught Evolutionary Theory, Biogeography, and History of Science at Humboldt-Universität zu Berlin. In addition to numerous articles in scientific publications, he regularly writes for newspapers and magazines, and occasionally advises filmmakers in their work about naturalists. His popular books include biographies of Charles Darwin and Alfred Russel Wallace. Additionally, he is the Editor of a revised German translation of Wallace's writings about his South American expedition, *Abenteuer am Amazonas und Rio Negro* (Galiani Verlag, 2014).

RADJAWALI IRENDRA is a political ecologist and environmental activist focusing on illegal land grabs and deforestation in Indonesia. Radjawali is in the final stages of his Ph.D. in Geography from Universität Bremen. After eight years in Germany—which also included working on a research project at Rheinische Friedrich-Wilhelms-Universität Bonn—he recently returned to his home country, Indonesia, where he founded the Akademi Drone Indonesia, an organization that works with Indigenous

communities to gather and analyze data using DIY drones. He collaborates closely with WALHI (The Indonesian Forum for the Environment) and AMAN (Alliances of Indigenous Communities in Indonesia), and his self-constructed drones are used collectively by local and Indigenous communities as well as other NGOs across Indonesia and beyond. Among other places, his mapping work was presented at the Indigenous Pavilion of the UN Climate Summit COP21 in Paris.

GERALDINE JUÁREZ is a Mexican artist living in Gothenburg, Sweden. Her work across media technologies as subject and material focuses on understanding their role in the construction of dominant knowledge infrastructures and their related economic narratives. Recent exhibitions include *Strictly Professional*, Galleri 54, Gothenburg; *Totally Sick!*, Medicine History Museum, Gothenburg; *LOOP*, Cirkulation Centralen, Malmö; and the online auction/exhibition *#exstrange*, as well as *Dreamlands: Immersive Cinema & Art, 1905–2016* (with Lorna Mills) at the Whitney Museum of American Art, New York. Recent commissions include “Works for Radio” for *The Lake*. In 2015, Juárez developed an initial installation of *Intercolonial Technogalactic* for the exhibition *125,660 Specimens of Natural History*, Komunitas Salihara, Jakarta. Her writing has been published in *Continent*, *The Radiated Book* (Constant, 2016), and *Scapegoat – Journal for Landscape, Architecture, Political Economy*. Currently she is studying in the MFA program at Valand Academy, Gothenburg.

ALIFA RACHMADIA PUTRI is a researcher with a focus on urban infrastructure, city management, public space provision, and sustainable transportation. Her undergraduate thesis,

completed in the Faculty of Social & Political Sciences, Universitas Indonesia, addressed the challenges of financing large-scale, complex infrastructure in Indonesia. Following graduation, she worked as Office Coordinator at PetaJakarta.org and as City Planning and Operations Division staff at DKI Jakarta Governor's Office. Rachmadia Putri also was Curatorial Assistant for the exhibition *125,660 Specimens of Natural History*, Komunitas Salihara, Jakarta, 2015. She is currently studying urban planning at Harvard University.

WIDYA AULIA RAMADHANI is currently in her final year of graduate school in architecture at the University of Illinois at Urbana-Champaign. She has a special interest in the intersection between architecture and human health, as she believes it is highly dependent on environmental conditions. Participatory design methodology has been her obsession since her undergraduate study, so she really enjoys design processes that involve discussion and charrette with users. Ramadhani is currently exploring her interest in the intersection between gerontology and architecture. She has been doing research in architecture, as well as other related fields like art, urban studies, and community health. Previously, she worked as a Teaching Assistant at Universitas Indonesia, Research Assistant at PetaJakarta.org, and Multimedia Assistant at disability resources and educational services at UIUC. In winter 2017, she was an intern architect at Studio Christian Wassman in New York City. After her graduation, she hopes to work at a research-based architecture firm and become a professor back in Indonesia.

JAMES M. RUSSELL is an Associate Professor in Brown University's Department of Earth, Environmental, and Planetary Sciences, and a fellow of the Institute at Brown for Environment and Society. His primary research interests are the reconstruction of long-term climate change in the tropics and its impacts on terrestrial environments. His graduate work at the University of Minnesota investigated the climate of the Holocene (the last 10,000 years) using lake sediment records from central Africa, earning a Ph.D. in Ecology and Evolutionary Biology in 2004. He began working in Indonesia in 2006 to develop high-resolution environmental records from Eastern Java. Dr. Russell has led numerous lake coring expeditions in Africa and Southeast Asia, most recently leading a team of over thirty scientists in the Towuti Drilling Project in 2015, which drilled 160-meter-long sediment cores from large tectonic lakes in central Sulawesi, Indonesia. He has authored or co-authored over seventy papers on tropical environmental change in the past fifteen years.

MARK VON SCHLEGELL's experimental writing practice crosses boundaries of literature, taste, art, theory, pulp, and science fiction. Published by Semiotext(e), the "System Series" novels *Venusia* (2005), *Mercury Station* (2009), and *Sundogz* (2015) consider the imaginary survival of post-human and AI culture in space after the fall of Earth. Shorter art and architecture related science fictions have been published in the volumes *New Dystopia* (2012) and *Ickles, Etc.* (2014) by Sternberg Press, Berlin. Two books of literary theory, *Realometer* (Merve, 2009) and *Dreaming the Mainstream* (Merve, 2013), explicitly trace the relation of literature to the fabrication of the contemporary real. A literary

activist since the 1990s, von Schlegell continues to extend the imaginary reach of science fiction and literary theory into art, books, periodicals, performances, films, and new forms the world over. *Roussel Returns*, a critical reassessment of the writings and influence of Raymond Roussel, has just been published as a special pamphlet edition by Semiotext(e).

SLAVE PIANOS (founded in Melbourne in 1998) is a collaboration between artists Danius Kesminas and Michael Stevenson, and composers/musicians Rohan Drape and Neil Kelly, recently joined by inventor Dave Nelson and architect Antanas Kesminas. They make historically grounded, research-based installations and performances utilising humor, immediacy, and the conflation of "high" and "low" idioms to suggest connections and interrelations between the largely discrete fields of music, art, and architecture. SLAVE PIANOS has performed and collaborated with Punksasila, Fluxus luminaries (Jonas Mekas, Larry Miller, Alison Knowles, Geoffrey Hendricks, Eric Andersen and Tamás St. Auby), Vytautas Landsbergis (the first post-Soviet president of Lithuania), June Mills (Larrakia Elder), Merce Cunningham, Flux Quartet, Arditti String Quartet, Michael Kieren Harvey, DJ Olive, Barney McAll, Krasnyi String Quartet, Chamber Made Opera, John McCaughey and ASTRA, Richard Piper, the Royal Australian Navy Band, Mark von Schlegell, Chris McAuliffe, and many others.

ANNA-SOPHIE SPRINGER is an independent curator, writer, and the Co-Director of K. Verlag in Berlin. Her research-based practice merges curatorial, editorial, and artistic commitments by stimulating fluid relations among images, artifacts,

and texts in order to produce new geographical, physical, and cognitive proximities, often in relation to historical archives and the book-as-exhibition. Her previous curatorial projects include the series *EX LIBRIS* (2013) on how to make exhibitions out of books and libraries at Hochschule für Grafik und Buchkunst Leipzig (HGB); Galerie Wien Lukatsch, Berlin, and Arg.org. With Etienne Turpin, Springer is a Co-Principal Investigator of *Reassembling the Natural*, an exhibition-led inquiry into the meaning of natural history collections in the Anthropocene. In 2015, they co-curated *125,660 Specimens of Natural History* at Komunitas Salihara in Jakarta, Indonesia, in partnership with the Indonesian Institute of Science; the new exhibition cycle for 2017–18, *Disappearing Legacies: The World as Forest*, is funded by the German Federal Cultural Foundation and the Schering Stiftung. In addition to co-editing the *intercalations: paginated exhibition* series, she is also the co-editor of *Fantasies of the Library* (MIT Press, 2016), as well as the editor of numerous K. publications (many in collaboration with Charles Stankievech), and the translator of books by Mark von Schlegell and Nina Power (Merve, 2009/11). She received her M.A. in Contemporary Art Theory from Goldsmiths College, University of London, and her M.A. in Curatorial Studies from HGB, Leipzig. In 2014, she was the Craig-Kade Visiting Scholar-in-Residence at Rutgers University. She is currently a Visiting Lecturer at Institut Kunst, Basel, and a Ph.D. student at the Centre for Research Architecture, Goldsmiths, where her research examines the financialization of nature and the role of natural history collections in a time of ecological collapse and mass extinction.

ZENZI SUHADI is currently the Head of the Department of Research, Advocacy, and Environmental Law at the national executive office of the WALHI (The Indonesian Forum for the Environment) in Jakarta. With a background in biology from the University of Bengkulu, his home province on the island of Sumatra, Suhadi has been an active member of WALHI since 2005, originally joining the NGO in Bengkulu province. From 2008 to 2012 he was the Executive Director of the local office there, working hard to support the region's communities in their struggle against corruption, illegally granted mining and plantation concessions, land grabbing, environmental pollution, deforestation, and the frequent application of physical violence against protesters and affected individuals in local villages. Since 2012, Suhadi has worked in WALHI's national office, where until 2016 he held a Campaigner position, focusing on forests and large-scale plantations. In both this and his current position he has been advising the Indonesian government and foreign diplomats in their stance and policies about plantations, palm oil, ecosystem restoration, forest fires, and the haze problem, as well as the Peatland Moratoria from 2014 and 2016.

ERWAN HERSI SUSANTO, also known as Iwank Celenk, was born in 1977 in Kediri, East Java, Indonesia. He graduated from the Design Faculty at Institut Seni Indonesia, Yogyakarta, where he resides. He currently works as an illustrator in a production house and freelances as a comic artist under the name Yellow Teeth Comics. He plays guitar in several bands, including Kornchok Chaos and Iwank Fals. Besides illustrating the *Darwin Proboscis*, Iwank is also the bassist in Punksasila.

KATHARINA TAUER is a graphic designer currently living and working in Berlin. After completing her M.A. in Art Direction with a focus on type design at ECAL (École cantonale d'art de Lausanne), in 2012, she moved to London to work with Zak Group. Tauer now works on self-initiated projects, as well as commissions and freelance jobs, maintaining a focus on book design and the cultural sphere.

PAULO TAVARES is an architect based in Brasília, where he currently holds an Adjunct Professor position at the Faculdade de Arquitetura e Urbanismo, Universidade de Brasília. He is a long-term collaborator with the Forensic Architecture Project and has published and lectured widely in different contexts and locations, including ETH Zurich, Haus der Kulturen der Welt, Ireland Biennale, Mercosul Biennale, Perez Art Museum Miami, and São Paulo Biennale. In 2015, he was a Visiting Scholar at the School of Architecture at both Princeton and Cornell Universities. Prior to that, Dr. Tavares taught Design Studio and Spatial Theory at the School of Architecture, Design, and Arts of the Pontificia Universidad Católica del Ecuador in Quito, and at the Centre for Research Architecture, Goldsmiths, where he also completed his Ph.D. His work has been exhibited in various venues worldwide, including BAK, Utrecht; Fundación PROA, Buenos Aires; Haus der Kulturen der Welt, Berlin; the Taipei Biennale; and ZKM, Karlsruhe.

RACHEL THOMPSON is a musician, filmmaker, and Ph.D. candidate in Anthropology and Critical Media Practice at Harvard University. Thompson holds an MFA in Visual Arts from UCSD, and an M.A. and B.A. in Music from Wesleyan University. As

an arts educator and media producer, she has worked at the Walker Art Center and the J. Paul Getty Museum. With collaborator Jonathan Zorn she co-founded the imprint SET Projects, devoted to experiments in electro-acoustic and improvised music. She has guest-lectured throughout the United States and has taught courses in film history/criticism, new media theory/practice, and experimental music. Her prior work has examined the cultural and political legacies of colonialism, the dynamics of cultural exchange and assimilation, and artistic practice in the wake of political violence. Her current research and film projects explore the long-term entanglements between Indonesia and the Netherlands through the lens of political ecology. Thompson's contribution to this volume derives from a fragment of her essayistic film *Extinction Number Six* (2011), which tracks an eccentric narrator's quixotic search for the material traces of Java's colonial, mystical, and paleontological past—a journey haunted in equal measure by the 1815 eruption of Mount Tambora and the still-murky events of the 1965 Indonesian coup d'état and subsequent anti-communist massacre.

ETIENNE TURPIN is a philosopher, Research Scientist at the Massachusetts Institute of Technology, and Founding Director of an exact office in Jakarta. With Anna-Sophie Springer, Dr. Turpin is a Co-Principal Investigator of *Reassembling the Natural*, an exhibition-led inquiry into the meaning of natural history collections in the Anthropocene. In addition to being the co-editor of the *intercalations: paginated exhibition* series, he is also the co-editor of *Fantasies of the Library* (MIT Press, 2016), *Art in the Anthropocene* (Open Humanities Press, 2015), and *Jakarta: Architecture + Adaptation* (Universitas

Indonesia Press, 2013), and editor of *Architecture in the Anthropocene* (Open Humanities Press, 2013).

SATRIO A. WICAKSONO is the Forest and Landscape Restoration Manager at the Indonesian branch of the World Resource Institute (WRI). Working closely with the Global Restoration Initiative team based in Washington D.C., he leads WRI restoration efforts in Indonesia and conducts research on Indonesian restoration, forestry, land use, and other natural resource issues. Together with key stakeholders in restoration, Wicaksono works to address obstacles and galvanize support and commitment to landscape restoration in Indonesia, both at the national and local levels. Before joining WRI, as part of his graduate research, he was Project Coordinator for the Towuti Scientific Drilling Project, the first international continental drilling project in Southeast Asia. In May to July 2015, the Project worked to recover one of the longest continuous

terrestrial sedimentary sections from Indonesia, which will be used to reconstruct regional climatic and environmental history during the past 650,000 years. He also served as the North American Liaison Officer for the International Indonesian Scholars' Association. Wicaksono is currently completing a Ph.D. at Brown University on the variability of Indonesian precipitation and vegetation across geological and historical timescales. He holds a M.A. in Geological Sciences from Brown University and a B.A. from Wesleyan University, where he double majored in geology and environmental studies, and completed a certificate in international relations.

↳ Javanese men studying a set of teaching charts about rice cultivation (on the floor in the center: two bushels of harvested and dried rice plants), Buitenzorg Botanical Garden, Bogor, Java, circa 1900. Image from the exhibition *125,660 Specimens of Natural History*, Komunitas Salihara Gallery, Jakarta, 2015. Courtesy of the Indonesian Institute of Science.



intercalations 3:
Reverse Hallucinations in the Archipelago

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- 1 **Fantasies of the Library**
- 2 **Land & Animal & Nonanimal**
- 3 ***Reverse Hallucinations
in the Archipelago***
- 4 **The Word for World
is Still Forest**
- 5 **Decapitated Economies**
- 6 **These Birds of Temptation**

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*by Anna-Sophie Springer
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by Rachel Thompson

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*George Beccaloni
in conversation with
Anna-Sophie Springer
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The Teak Bed That Led
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from Singapore to
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Iwank Celenk*