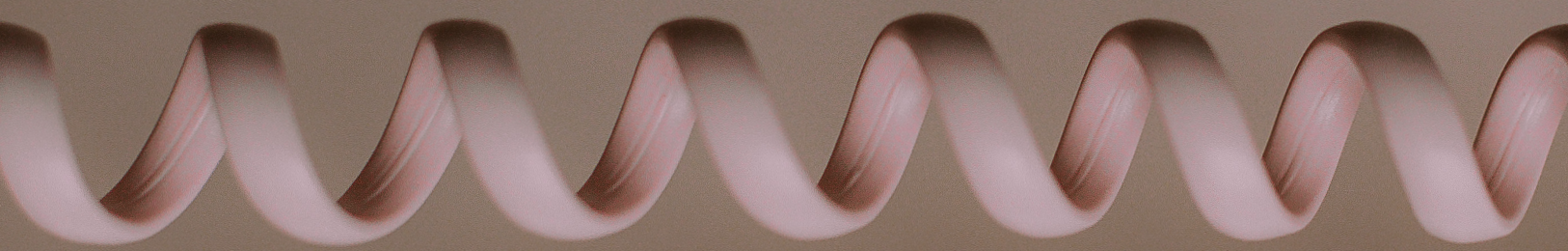
# gossamer



INSIDE

# The Archive

Yesterday's plants are a cipher for a changing climate

# of Future Land-scapes

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A brown butter sunset was falling over Paris in late February and outside the tall windows of the herbarium, the sandy promenades of the *Jardin des Plantes* were slowly emptying of a day's worth of grandparents and grandchildren, untethered school groups, and dehydrated gardeners. Inside the herbarium, it was quiet and cool. A few tourists mingled about in the atrium—the only place the public is allowed to wander—among cases of giant seed pods and a mounted cross-section of a sequoia from the forests of northern California. Upstairs, where the full collection is kept, only a handful of visiting researchers and herbarium staff remained, burning the late-afternoon oil. Marc Jeanson sat behind his desk, sipping coffee poured from a half-empty French press. Unlike the sterile stone hallways of the herbarium, his office was warm from the afternoon sun and reflected an almost manic energy. The walls were crowded with photographs, prints, bark, and dried fronds. On the window sill and below, a line of potted plants—flowing up and over each other—partially blocked out the natural light, giving the office a slightly green tinge. Shelves were stacked high with books and manuscripts and folders. On the desk itself were ornamental vases, cones, seeds, acorns, and more sheafs of paper. Jeanson, who is 38, is the collection manager at the herbarium, an entity of the Muséum national d'Histoire naturelle, and such, oversees the conservation of the eight million specimens that make the herbarium the world's largest, and one of its most important. Herbaria are best characterized by the Latin term used to describe them: *hortus siccus*. Dry garden. The world's first herbarium is often credited to 16th-century Italy and the Bolognese physician and botanist Luca Ghini—though the rest of Europe's plant aficionados were hot on Ghini's heels. The concept, in itself, was not a revolutionary one. "Even children, without being taught, know how to form little herbaria by inserting flowers between the pages of a book during their walks in the fields," observed a bulletin of the New York–based Torrey Botanical Club in 1885. Some, like the bulletin's writer, suggest it was instead all about timing: advancements in book production meant that cataloging plants in this manner had become not only practical, but also economical.

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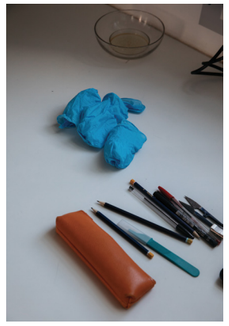
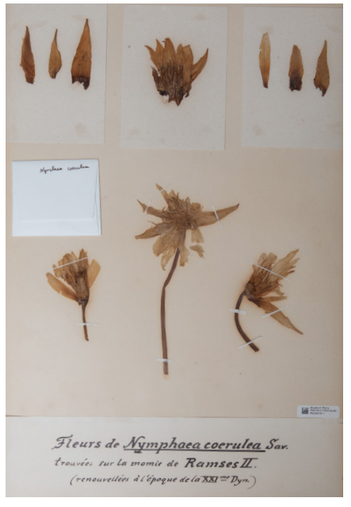


VII




VIII

IX

I, II — Jeanson reveals his favorite artifact: a *hortus siccus* collected by a young Philibert Commerson.

III, IV — The rooms are kept at 66.2 degrees Fahrenheit and 45 percent humidity.

V, VI, VII — The collection is organized by an international system called APG III, which separates specimens by plant morphology and DNA.

VIII, IX — The world's oldest dried plant material: flora from the garlands wrapped around the mummified body of Ramesses II.

In the beginning, the dried plants, pressed together by the pages of thick volumes, were mostly of use to the medical professions. (From the time humans first showed interest in plants, this curiosity has overlapped with the search for miracle cures). In the age of exploration, it was a way to preserve plants brought back from the far reaches of the known world. Today, these collections are a combination of museum and lab. Botanists zip across the oceans to visit "type specimens"—specimens that are the reference for an entire species—at the herbaria that house them. For a place reserved for dead plants, an herbarium is very much a living space. In a steady cycle, new plant species are cataloged and extinct plant species are mourned over.

The scales of time and history tilt in a place like the Paris herbarium. Specimens from hundreds of years ago to today are collected on lemon yellow shelves in rooms dimmed by stone floors and dull metal fixtures lining the ceiling. The rooms are lit by unflattering fluorescent lights and kept at 66.2 degrees Fahrenheit and 45 percent humidity. The collection is organized by an international system called APG III, which separates specimens by plant morphology and DNA. It is further separated by region of origin, coded by folders blue, purple, green, and brown. The herbarium's collection of type specimens, numbering between 250,000 and 300,000, is stored in red folders.

The internet is slow; seemingly modest projects take months, sometimes years; and in each leaf and fungus is an archive of human history—of colonial rule, exploration, independence. Yet the collection also serves as a cipher for future landscapes: it is an index of a changing climate and an industrialized world. With each specimen comes a date and a place: where it was collected and when. "So we have this diachronic representation of the state of the flora of the world," Jeanson explained, "which is very useful: to be able to go back to the specimens from four hundred years ago and see exactly where the plant was growing then, and where it is growing now, and if it is growing in the same place, or if it has moved around . . . or if it just isn't there anymore."

In order to understand how plants are being affected by climate change and globalization, you need to know what, precisely, the plants are. The problem is that the amount of people trained, able, and willing to do this kind of work has, in the past few decades, been on a steady decline.

Since the 1980s (some even say since the 1950s), the field of botany has withered. According to a 2013 study conducted by the Chicago Botanic Garden and the U.S. branch of the Botanic Gardens Conservation International charity, between 1988 and 2015, U.S. research universities offering botany degrees halved. In 2012, less than four hundred degrees—undergraduate, graduate, and doctoral combined—were awarded to U.S. students. Similar losses have been felt in the U.K., where nearly all universities that once offered a degree in botany have discontinued their programs or lumped them into other life science fields. And the same goes for herbaria: in the U.S., an estimated one hundred herbaria closed between 1997 and 2015. And throughout the country, botanists in roles vital to the nature of the nation—from the National Park Service to the military—are aging out of their careers, and retiring.

Some blame this decline on the general "unsexiness" of plants. In the world of life sciences, there is a clear bias: fauna over flora. There is an ease to our interest in our fellow creatures; nearly all of us have or have had a special relationship to an animal. But when was the last time you were truly drawn to a plant? When was the last time that initial attraction lasted, not just for a fleeting moment, but for years and years? There is language for this kind of favoritism: zoo chauvinism; plant blindness. Beyond the aesthetic, beyond the mini cacti on our shelves and the tasteful ferns in our living rooms, very few of us can truly claim a real connection to plants.

"I think you need to meet them," Jeanson says. "You need a specific moment, when you look at [plants] in a different way." He pauses. "I cannot give you the recipe to do that. But I think it has a lot to do with observation. Patience. When I say patience, I mean being able to get into their reason. Of course they live, of course they move, of course they have strategies, adaptations, all those things. But in order to see that, I think you need to be able to get more into their reason by spending hours looking at them. You just need to be sensitive. To the light, to the colors. You need to go deeper than just the aesthetics."

Andrea Kramer, director of restoration ecology at the Chicago Botanic Garden, thinks there is a recipe, or at least, a key to lasting plant connections: storytelling, bringing people into the drama of "what it actually takes for that species to germinate from its seed, to grow; how many [years] it takes to produce a flower; the life cycle of an individual species and how they can be impacted by the actions that we take, both for better or worse." And to get to this point, Kramer thinks a "plant mentor" is often needed to guide people along their plant path. "To help people understand that it's not just a world of green when they see plants," she explains, "but that each plant has its own story to tell and provides a really important service for humans, and for the wildlife that depend upon it and that everything fits together."

(When you speak to plant people, you realize a pattern: each has their own a-ha moment, their own love story. For Jeanson, it was a spider plant—medusa-like, with slender leaves streaked in stripes of cream and green—that he took home from school one summer on a whim. For Kramer, it was the corn that colored her childhood in the midwest, and then the spring flora of the Minnesota woodlands, where she discovered the wonders of plant diversity. And perhaps it is not only "plant people." In middle school, I found jasmine growing over the fence on a quiet, residential street, and pulled a few flowers from the vine. It became a ritual. I could not pass a plant without a rudimentary cutting, which was stored in my hair or my backpack or my notebook until the petals turned bruised and brown. For my 13th birthday, I asked, as my present, that my father plant a bush underneath my window. When I went away to school across the country, I would receive letters from home with the bush's flowers pressed dry between stiff cardstock. I still receive them in the same manner, at still more distant addresses.)



Despite the damning statistics of the 2013 report, in the past decade, the downward spiral of botany stalled and then, unexpectedly, began to reverse course—slowly, perhaps, but perceptibly. Kramer, who in addition to her conservation work has studied the botanical capacity of the U.S., says that the Chicago Botanic Garden received 360 applications for the 10 spots in this past summer's research program for undergraduates. Similar enthusiasm has been shown in their graduate programs, where their students will, in part, go on to fill the spots of botanists who are retiring from the field. And a bill—the Botanical Sciences and Native Plant Materials Research, Restoration, and Promotion Act—built in reaction to the dearth of botanical research (and researchers) identified by the 2013 report, was reintroduced to the House of Representatives in early March of 2019.

In this narrative of revival, the Paris herbarium has played a different kind of role. In the aughts, the collection, whose system of operation had remained more or less unchanged since 1935, underwent a renovation. All 10 to 11 million specimens it housed at the time were removed from its shelves and sent to squat in a warehouse outside of Paris as its home was reorganized and redesigned. The collection was separated into several different rooms to help prevent against fire danger, and the rooms were lined with tall metal stacks that slide back and forth, controlled by a wheel like that of a submarine.

During the move, the herbarium also took advantage of a once-in-a-collection's-lifetime opportunity and digitized. It was a project on a scale that had never been done before and required tailor-made equipment. The company that came on to facilitate the effort developed a system that acts as a conveyer belt, capable of processing the digitization of several thousand specimens per day.

In the wake of this monumental undertaking, institutions around the world have followed suit. The florae that comprise the National Herbarium of the Netherlands were digitized in the early 2010s, making use of a conveyor belt system similar to the one developed for the Paris effort. The National Herbarium of New South Wales will receive a state of the art facility in the next few years, and undergo digitization in the meantime. Jeanson puts much of this renewed interest—and perhaps, more importantly, renewed funding—on to what he calls "the new role of herbaria." Awareness is spreading that these collections are "an extremely powerful tool to document how the world is changing." He continues: "The museums and the natural history collections around the world are the way to answer most, if not all, the large contemporary questions: how to eat, how to live, how to breathe, how to find new energies . . . all the questions that the world today, and especially tomorrow, is going to raise in a very serious and very drastic way."

In the halls of the herbarium, Jeanson guides me through the vascular plant collection. Everything he does is done with emphasis. To make a point, he taps on paper, screen, or sliding metal stack. Though his legs are shorter than mine, I am forced to trot to keep up with his determined pace. He speaks in rapid, near-perfect English, chiding himself when he cannot remember a word, which happens only once and is for a specific type of mustard plant that I know I will not recognize even if he can recall it.

After a glimpse into the herbarium's historical collection, Jeanson leads the way through a set of doors, into a bare entryway bathed in green light and on to a room that is much colder than the others, which holds a smaller collection, stored behind more locked doors. Jeanson is showing me what he calls "the treasure." "To me, this is a jewel of this collection," he says. He draws out the herbarium purchased by Jean-Jacques Rousseau just a few months before his death. Here are also herbaria collected by soldiers in the trenches of World War I and specimens gathered along pilgrimages to Jerusalem. "I could tell you two million more things about all these crazy specimens," he laments. But the scale of our time together, unlike the herbarium's, is small.

First, he brings out the world's oldest dried plant material: flora from the garlands wrapped around the mummified body of Ramesses II. Water lily flowers and date palm leaves. Though they are faded into a dark, muddy, purplish brown, they hardly look different from the specimens Jeanson showed me just minutes before, which had been collected by Alexander von Humboldt, the Prussian explorer, almost three thousand years after the pharaoh's death.

Then we come to what Jeanson says is his favorite artifact—if he were to choose favorites. A *hortus siccus* collected by a young Philibert Commerson, a French botanist who would later go on to circumnavigate the world. The book, with specimens collected from around the area of Montpellier, the site of France's oldest herbarium, is made up exclusively of leaves, glued to the page with animal glue, and cataloged meticulously. At the back, pages and pages of index correspond to the numbers beside each delicately placed specimen. Jeanson turns the pages with a pointer finger that is cracked and dry at the tip—seemingly from all the pages it encounters, rough and soft and sharp, during a day on the job. "This is to me one of the most beautiful things," he says. "Botanists always talk about the flowers. But the leaves matter! Without the leaves, nothing would happen."

X

X— “I think you need to meet them,” Jeanson says. “You need a specific moment, when you look at [plants] in a different way.”