The peculiar advantages of natural history

Incoming president's lecture for American Society of Plant Taxonomists,

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Andrew L. Hipp

The Morton Arboretum, 4100 Illinois Route 53, Lisle IL 60532-1293, USA

ahipp@mortonarb.org

Abstract [as submitted]

As systematists, we play a vital role in increasing people's appreciation of biodiversity. We collaborate with land managers and help shape conservation policy. We promote herbaria as archives, research platforms, and spaces for researchers to work shoulder-to-shoulder with amateurs. We build and translate humans' understanding of plant diversity. We mentor educators and students. In all of this, we play an often-understated role in helping people learn the vital skills of natural history: seeing, describing, and making sense of complex patterns in the natural world. The practices of systematics and natural history enable us to appreciate the complex networks of organisms that inhabit our neighborhoods, local parks, and natural areas. Our discipline thus builds foundational knowledge and skills that are useful to every member of society. As ASPT approaches its centennial, our continued success will depend on the strength of a diverse community of artists, educators, researchers, land practitioners, and enthusiasts.

Supporting and continuing to build this extended plant systematics community is our best way to ensure its effectiveness and strength.

Keywords: ecology, field biology, herbarium / herbaria, landscape interpretation, natural history education, taxonomy, systematics

Lecture [as delivered]

On the third floor of the research and administration building at The Morton Arboretum sits **the herbarium [2]**. Our herbarium is a collection of 195,000 dried, **pressed plant specimens [3]** collected over the past 200 years, each **glued to archival quality [4]** paper intended to last for hundreds of years, if not a thousand or more. Many botanists have left their stamp on this collection.

Among our herbarium's holdings are 52 plants collected in **Kane County, Illinois [5]**, between April 18 and May 9, 1887 by a student named Minnie Potter. The **specimens [6]** are arranged carefully, some flowers opened to make them more visible, glue marks showing where each was placed even after the specimen has come loose. Each herbarium sheet preprinted with the words, "Aurora Public Schools: West Side" in an ornate typeface. Plant collecting was clearly a school project, though whether this particular collection was for class credit or an extramural activity we don't know. Each page was preprinted with spaces for the pupil's name, the date—1880-blank, suggesting that the school expected to go through a number of these over the course of the decade—and then blanks for several ranks of the plant's taxonomy, from order to genus and species. There was a blank for the English name, the

date and locality of collection, and even places to indicate the page numbers of reference books used to identify the plants, specifying *Gray's Manual* and *Wood's Manual* as the only two options.

Potter collected in the **vicinity of Aurora and Sugar Grove [7]**, 45 miles west of Chicago. This area had been colonized by Europeans 50 years earlier, when the 1833 Treaty of Chicago forced the Potawatomi off their land. Potter didn't record any information on habitat, but we can learn a little bit about the plant communities she visited and her collecting habits from the specimens themselves. She mostly collected over the course of a few Mondays and Thursdays, but she has plants from every day of the week, even a daffodil plucked on a Sunday in the middle of May. I presume based the frequency of her collections that Potter had access to a woodlot near her house that she could visit before or after school. She and her classmates and teachers may have visited the woods together at times. Given that one of the towns where she collected was named Sugar Grove, it's not surprising that many of her collections are typical oak-maple forest species: **wild ginger (*Asarum canadense*) [8]**, spreading bellwort (*Uvularia sessilifolia*), nodding and sessile trilliums (*Trillium cernuum* and *T. sessile*), **Dutchman's breeches (*Dicentra cucullaria*) [9]**, rue anemone (*Thalictrum thalictroides*), *Hepatica*, spring beauty (*Claytonia virginica*), and even the near-threatened spring blue-eyed Mary (*Collinsia verna*) and **goldenseal (*Hydrastis canadensis*) [10]**, both uncommon in our area any longer.

Kane County was dominated by prairie prior to European colonization, but Potter collected only **shooting star (*Dodecatheon meadia*) [11]**, prairie phlox (*Phlox pilosa*), and hairy puccoon (*Lithospermum caroliniense*) from the tallgrass prairie flora. Likely this is due in part to the fact that her project was conducted in spring, when most tallgrass prairie plants are not in bloom.

Moreover, much of the prairie had already been done in by the John Deere steel plow by the 1880s. Or perhaps Potter simply favored the forest. She collected a smattering of garden plants, as well—bleeding-heart, quince, periwinkle, daffodil, pansy, tulip—shrubs like weigela and Tartarian honeysuckle, and **shepherd's purse (*Capsella bursa-pastoris*) [12]**, a Eurasian weed that comes along with home-building and gardening.

Minnie Potter was in school at a time when plant collecting was a common part of the curriculum. Local-based natural history education would remain standard in public schools for a few more decades. If she had been in school just 15 or 20 years later, Potter might have been taught from **Anna Comstock's [13]** extremely popular, encyclopedic 1911 *Handbook of Nature Study*, which was packed full of practical natural history insights and lore, from the life histories of earthworms and ferns to chapters with such provocative titles as "When and why the teacher should say I do not know" and "Should the nature study teacher teach how to destroy life?". Potter's neighborhood and school were situated near the inflection point marking our country's transformation from its pre-European occupation past to its dissected present. Few students living in the western Chicago suburbs today enjoy a daily walk through **woodlands with such diversity [14]** as we see in Potter's three-week collecting sprint of 1887.

Of course, we don't know if Minnie Potter was a typical student at all. Maybe she scored in the 99th percentile in love of natural history. But even if this is the case, her public school cultivated that interest through practical, hands-on guidance that has all but vanished from the curriculum. Few students today are required to make a plant collection, or to learn the local birds, recognize how glaciers carved up their neighborhoods, name the trees that line their streets. By the time Potter was doing her class project, educators and naturalists were already

growing worried. **Clifton Hodge [15]** wrote in his 1902 *Nature-Study and Life* that natural history is "the sheet anchor of elementary education, all the more necessary as modern life tends to drift away from nature into artificialities of every sort."[1] Hodge's concerns weren't new. In 1750, Swedish botanist Peter Kalm claimed that American adults take "little account of Natural History… that science being… looked upon as a mere trifle, and the pastime of fools."[2] Concerns wouldn't end with Hodge, either. Prior to World War II, biology curricula were based largely on teacher and student interests and local concerns. This flexibility fell away as schools—indeed, much of society—increasingly emphasized teaching scientific processes over hands-on natural history and discounted biology in lieu of the physical sciences.[3] From the 1980s through the present day, a **raft of articles have mourned [16]** the death of natural history.[4]

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[1] Robert Michael Pyle, "The Rise and Fall of Natural History," *Orion: People and Nature* 20, no. 4 (2001): 19.

[2] Gary Nabhan and Stephen Trimble, *The Geography of Childhood: Why Children Need Wild Places* (Beacon Press, 1995), 40.

[3] Heather King and Marianne Achiam, "The Case for Natural History," *Science & Education* 26, no. 1 (2017): 125–39, https://doi.org/10.1007/s11191-017-9880-8; Pyle, "The Rise and Fall of Natural History"; Gary Yee and Michael Kirst, "Lessons from the New Science Curriculum of the 1950s and 1960s," *Education and Urban Society* 26, no. 2 (1994): 158–71, https://doi.org/10.1177/0013124594026002004.

[4] e.g., Terrence P. McGlynn, "Natural History Education for Students Heading into the Century of Biology," *The American Biology Teacher* 70, no. 2 (2008): 109–11, https://doi.org/10.1662/0002-7685(2008)70[109:NHEFSH]2.0.CO;2; Stephanie E. Hampton and Terry A. Wheeler, "Fostering the Rebirth of Natural History," *Biology Letters* 8, no. 2 (2011): 161–63, https://doi.org/10.1098/rsbl.2011.0777; King and Achiam, "The Case for Natural History"; Seabird McKeon et al., "Human Dimensions: Natural History as the Innate Foundation of Ecology," *The Bulletin of the Ecological Society of America* 101, no. 1 (2020): e01656, https://doi.org/10.1002/bes2.1656; Reed F. Noss, "The Naturalists Are Dying Off," *Conservation Biology* 10, no. 1 (1996): 1–3; Stephen C Trombulak and Thomas L Fleischner, *Natural History Renaissance*, n.d.; John T Van Stan et al., "Shower Thoughts: Why Scientists Should Spend More Time in the Rain," *BioScience* 73, no. 6 (2023): 441–52, https://doi.org/10.1093/biosci/biad044; Harry W. Greene, "Organisms in Nature as a Central Focus for Biology," *Trends in Ecology & Evolution* 20, no. 1 (2005): 23–27, https://doi.org/10.1016/j.tree.2004.11.005; by contrast, see Arnold's provocative claim that "You do not have to have dirt under your fingernails to be a naturalist. The essential requirement is that you follow Linnaeus and Buffon in pursuit of order in nature," in Stevan J Arnold, "Too Much Natural History, or Too Little?," *Animal Behaviour* 65, no. 6 (2003): 1065–68, https://doi.org/10.1006/anbe.2003.2143.

Ann Zwinger, in indexing the letters of mid-19th-century Hungarian-American naturalist John Xantus, asked of natural history, "Where else can one range so widely and wander so happily into archaeology and anthropology, biology and botany, geology and history, taxonomy and zoology? … [Natural history's practitioners are] those batty people who like to tie together yesterday and tomorrow within the framework of today's natural world…"[5] **Natural history reasons its way from the particular toward the universal [17]**. It turns its attention first to a particular lineage, organism, or biotic community. Then it straddles years and landforms and branches of the Tree of Life to bring its subject into focus. In so doing, natural history aggregates herbarium collections from Kane County, watercourses barely visible in suburban backyards and sewers, moth and vegetation histories to yield a composite history of the world we currently inhabit.

Whether you believe natural history is thriving or dying on the vine, it is clear that many once-widespread natural history practices have become pretty nonstandard. So I ask: how we can foster the natural history instinct, the individuals-and-organisms-first, bottom-up study of the natural world that is the bedrock of the natural sciences? How do we build the affection and enthusiasm that propels a person into a scientific career or a lifelong passion for science, something deep enough to nourish advocacy and support and commitment? We've gotten pretty good at teaching students to reason scientifically, to answer **question X using organism Y as a model [18]**. But how do we help students go in the other direction? How do we help them

[5] Ann Zwinger, "A World of Infinite Variety," in *On Nature: Nature, Landscape, and Natural History*, ed. Daniel Halpern (North Point Press, 1987), 34,35.

get to know and understand the organism or landscape **in front of them [19]**, then follow that knowledge into new questions?

One of our best models for this kind of natural history education comes from what may seem an unlikely source. In 1956, **Edgar Anderson [20]** of the Missouri Botanical Garden wrote, "Confronted with any large and complex problem, in any field, the scientist who has had effective training in Natural History knows more or less instinctively what to do. Everything looks chaotic at first[,] but we do not live in a chaotic universe. There may be confusion in our minds but there is no chaos in the way the world is running. Faced with such a problem, the properly trained scholar looks around for significant repeatable patterns in the data and reasons back and forth from observation to hypothesis until he has found his way into it."[6] Anderson had been hired as "Geneticist to the Garden" 34 years earlier,[7] having just completed his PhD on the genetics of self-incompatibility in tobacco (*Nicotiana*). The work he undertook at Missouri Botanical Garden, however, was aimed at understanding the nature of species. He created **methods for representing a complex population in two dimensions [21]** and then using those visualizations to infer the genetics of variation.[8] He co-opted the term

[6] Edgar Anderson, "Natural History, Statistics, and Applied Mathematics," *American Journal of Botany* 43, no. 10 (1956): 882–89, https://doi.org/10.2307/2439005.

[7] For some biographical and scientific context on Anderson: Kim Kleinman, "From Geneticist to the Garden to Senior Botanist: Edgar Anderson and the Study of Plants in the 20th Century," *Annals of the Missouri Botanical Garden* 105, no. 4 (2020): 578–87, https://doi.org/10.3417/2020444; G. Ledyard Stebbins, "Edgar Anderson," *National Academy of Sciences: Biographical Memoirs* 49 (1978): 3–23; Charles B. Heiser, "Edgar Anderson, Botanist and Curator of Useful Plants," *Annals of the Missouri Botanical Garden* 82, no. 1 (1995): 54–60, https://doi.org/10.2307/2399980.

[8] Edgar Anderson and Thomas W. Whitaker, "Speciation in *Uvularia*," *Journal of the Arnold Arboretum* 15, no. 1 (1934): 28–42; Edgar Anderson, "Efficient and Inefficient Methods of Measuring Specific Differences," *Statistics and Mathematics in Biology*, Iowa State College Press Ames, Iowa, 1954, 93–106.

"introgression" [22] to describe the movement of genes from one species into another through hybridization and backcrossing.[9] He showed how **limits to recombination [23]** maintain species cohesion even in the face of introgression, making interspecific gene flow a creative force in species evolution rather than one that undermines species that have let their guard down.[10] He researched the origins of maize cultivars, **boxwoods [24]**, and other domesticated plants, working closely with breeders and studying the source populations of the species as best he could. **Throughout this work [25]**, Anderson explored the plants and landscapes around him.

In his 1956 article, "Natural history, statistics, and applied mathematics," Anderson describes bringing a class into the forest. One of Anderson's students has a masters in botany. Another is a wholesale grocer. Others include a high school biology teacher, an investment banker, and the president of the city's "most exclusive garden club." Anderson's job is to teach them about the natural history of the area without boring one set of students while overwhelming the others.

His approach is to bring them to a hillside and, leaning against a large white oak, to present them with the barest scrap of background information you could hope for: the land they are visiting was settled by Europeans about 100 years earlier. That's it. Then he asks, what changes have there been in the vegetation here in the past century, and why? He gives the students an hour to figure it out. As he talks, Anderson provides a hint that most don't notice: he plucks at an end of barbed wire protruding from the tree. A very few catch on immediately, while most

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[9] Edgar Anderson and Leslie Hubricht, "Hybridization in *Tradescantia*. III. The Evidence for Introgressive Hybridization," *American Journal of Botany* 25, no. 6 (1938): 396–402, https://doi.org/10.2307/2436413.

[10] Edgar Anderson, *Introgressive Hybridization* (John Wiley & Sons, Inc., 1949).

assemble the clues more slowly: barbed wire scars along a **row of white oaks [26]**; a forest on one side of the row with big, single-trunked white oaks; a forest on the other side with smaller oaks, many of them two- or three-trunked. By the end of the field trip, the story of the site is clear, and it is a common one in the Midwest. Fences separate properties with different ownership and land use histories. Oaks often grow along these fence lines. In second-growth forests, the trees tend to be smaller and are often multiple-trunked, resprouts from cut stumps. The particular history of the site follows along from a few general principles.

Inferring the natural history of the site requires some background knowledge about how trees grow and respond to changes in disturbance. This knowledge can be **conveyed in lectures or field trips [27]**. The practices of looking closely and asking how the facts before you fit together are harder to teach. They can be modelled, however. In Anderson's words, "the peculiar advantages of Natural History" are these practices of knitting together the patterns presented by seemingly unrelated facts to understand common causes. There is no one measurement that tells the whole story. You could genotype every plant on the site. You could quantify soil texture or organic carbon, diameters of the trunks, or the distance between trees, but there is no quantity that answers the question, "what happened here"? Instead, there are multiple observations anyone can make—the barbed wire, the row of oaks, the growth form of the trees on both sides of fencerow—that together tell a story about the site. **"In the early stages of a problem," [28]** Anderson writes, "accurate, unrelated data, if collected in big enough quantities by many people and scattered through numerous papers, may actually obscure the problem and hinder its solution." Stepping back and looking at the big picture

enables you to identify the measurements that are needed. That practice is what Anderson means by "natural history."

Minnie Potter and Edgar Anderson stand in for two views of natural history, an individuals-first biology on one hand, close observation and inference from seemingly unrelated patterns on the other. Anderson's essay struck me because my focus on natural history has always been the former, and it made me think about what has worked for me since started working as a natural history educator in 1993. My practices as a naturalist all derive from techniques I learned from other naturalists and that you likely use as well. Natural history begins, for me, with stories, which are also the target of both Potter's and Anderson's natural histories. When I first started, I told stories not for any good pedagogical reason, but because I was working with kids and didn't know how to get their attention any other way. I relied heavily on **Ovid's *Metamorphoses* and *Grimms' Tales for Young and Old* [29]**. The students liked stories where creatures were punished for being naughty, or they did the right thing and were punished anyway, then had the last laugh in the end. Arachne weaved more beautifully than the goddess Minerva, who beat her to the point of despair as punishment. Minerva saved Arachne from death at the 11th hour by **transforming her into a spider [30]**. Arachne is still the finest weaver. In another story, **the wren won a flying competition [31]** to be king of the birds through trickery: he hid in the feathers of an eagle and only started flapping his wings once the eagle was exhausted and couldn't fly any higher. The wren was jailed underground for his cleverness, but he escaped, and now he wakes up the entire neighborhood protesting that he's the real hedge king. I picked stories that I found engaging and that might engage the students' imagination, create mental hooks on which to hang a little natural history. Benson Lewis, of the

Cibecue Apache, said that "Stories go to work on you like arrows."[11] Stories tap our emotions and intellect and stitch experience together with memory.

Along with stories, I have always relied on specimens. As a naturalist at an area preschool, I found or borrowed any interesting specimen I could carry on the bus or fit into my backpack. I became friends with the curator of the UW Madison zoology museum, who lent me taxidermied animals that had been confiscated: **a gray squirrel [32]**, a mallard, a woodcock come to mind, maybe a 13-lined ground squirrel as well (if I'm not misremembering). I **brought cicada exoskeletons [33]**. I brought chewed deer antlers and **feathers [34]** I probably did not have permission to collect. I brought worm castings. I once found a **rock dove [35]** freshly dead on the sidewalk outside Memorial Union. It was still warm and in perfect shape. I wrapped it in a plastic bag and stuck it in the freezer at home. Several times I biked to the preschool with it in my backpack and promptly stuck it in the school freezer when I arrived. I would take it out for each class I visited, then hustle it back to the freezer between classes. It never fully thawed, of course, but the eyeballs did get increasingly juicy over the course of the morning, even with the refreezing. Many students found the eyes particularly memorable.

Specimens give students a chance to be close to an organism that they could not otherwise approach [36]. They focus students' attention on one node of the Tree of Life. They connect to human history as well: even young children can grasp that a specimen is, in Mary

[11] Keith H. Basso, "'Stalking with Stories': Names, Places, and Moral Narratives among the Western Apache," in *On Nature: Nature, Landscape, and Natural History*, ed. Daniel Halpern (North Point Press, 1987), 96, 97. Barry Lopez writes, "It is through the power of observation, the gifts of eye and ear, of tongue and nose and finger, that a place first rises up in our mind; afterward it is memory that carries that place, that allows it to grow in depth and complexity." This is also true.

Oliver's words, *an instance of attention*,[12] the product of a decision by a particular person at a particular place and time to notice this thing and collect it, so we can look at it today or 500 years from now. Specimens are a bridge between the past and the future. Students at the preschool invariably asked questions like, "How did it die?" "Where did it live?" "Was it a baby?" And they used their eyes. As they looked at the specimen, handled it if it was a pelt or skull or something else I could pass around, I would talk about what deer mouse or vole might have chewed on this antler, or about how feathers play with light to make us perceive them as blue. These natural history stories take what **Scott Donald Sampson [37]** calls the "cosmolocal approach" to telling the "epic of evolution."[13] They insert the here-and-now into the big story of the universe. A particular grasshopper or rock dove taps into the entire network of beings that began evolving 4 billion years ago and now ramifies across the globe and includes everyone in the group, each of us swimming with nuclei and mitochondria, colonized by bacteria and fungi, the entire ecosystem that makes an individual and the communities of individuals that make up ecosystems.

Stories and specimens lead us outward to exploration. At the preschool, **we would cross a geography-of-nowhere style winding suburban road [38]** and a ruff of mowed lawn to reach a tiny patch of red pines beside a small prairie, the latter sown with annuals to ward off complaints while the prairie established. To the students, this was the wild. There was a **great**

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[12] Mary Oliver, *A Poetry Handbook: A Prose Guide to Understanding and Writing Poetry* (Houghton Mifflin Harcourt, 1994), 74.

[13] Scott Donald Sampson, "The Topophilia Hypothesis: Ecopsychology Meets Evolutionary Psychology," in *Ecopsychology: Science, Totems, and the Technological Species*, ed. Peter H. Kahn Jr. and Patricia H. Hasbach (MIT Press, 2012), 43, 44.

horned owl [39] nest. Very rarely we would see the owl fly off. **Below the nest [40]** we could almost always find fresh droppings on the ground or splashed down the tree trunk. **Occasionally there was an owl pellet [41]**. There were earthworms in abundance. There were pine cones whose seeds and scales had been chewed off by squirrels as though the pine cones were ears of corn. There were woodpecker and bluejay feathers. There were **caterpillars [42]**, beetles, grasshoppers, wild rye in fruit, heads of sunflowers to open up, **inflorescences of beebalm [43]** filled with seeds to shake into our hands. Students spent most of their time in the field running off to find things they could share, wondering what exactly each thing was. Most of it was not museum-quality, but each specimen was a treasure. The place was packed full of what Robert Pyle calls "low adventure."[14]

Exploring is unscripted [44], making it an opportunity to practice and model close observation and inference. Students watch how we approach learning as we stumble across things we don't know. The ability to make structured observations that advance our understanding is a learned skill, not innate. Kids and adults alike have to learn how to make fruitful observations in science.[15] As naturalists, we show what close observation looks like and how we keep ourselves engaged with questions. **When someone shows us a leaf [45]** and asks, "what is this?" we respond, "what can you tell me about it? How big is it? what shape is it? What do you see when you look at it through your hand lens? What more do you see if you

[14] Robert Michael Pyle, *The Thunder Tree: Lessons from an Urban Wildland* (Oregon State University Press, 2011), 20.

[15] Catherine Eberbach and Kevin Crowley, "From Everyday to Scientific Observation: How Children Learn to Observe the Biologist's World," *Review of Educational Research* 79, no. 1 (2009): 53, https://doi.org/10.3102/0034654308325899.

hold it under the lens for 20 seconds instead of 2?" As naturalists, we have cultivated the habits of looking at something up close, then raising our heads to ask where it came from and what the organism looks like in its landscape. We spend many years conditioning ourselves to see and to study. We may have to remind ourselves what path we took to developing these habits of moving back and forth from observation to question, from ruminations about the history of a thing to direct observation of the thing, so that we can help guide others along their paths.

Yi-Fu Tuan quotes art historian Kenneth Clark [46] as saying, "I fancy that one cannot enjoy a pure esthetic sensation (so-called) for longer than one can enjoy the smell of an orange, which in my case is less than two minutes." Tuan, who was a human geographer, observed that one's appreciation of natural beauty is similarly "fleeting unless one's eyes are kept to it for some other reason, either the recall of historical events that hallowed the scene or the recall of its underlying reality in geology and structure."[16] Background knowledge *about* a thing can keep you looking at it long enough that you have time to be moved by it again, and then to notice something new about it. **As naturalists, part of what we model [47]** is keeping ourselves engaged by turning the subject of our study over and over in our hands and minds, asking some new question, moving off to a different thing and then coming back. Our fascination grows in this way rather than languishing for want of novelty.

When Edgar Anderson talks about natural history, he emphasizes the skills of pattern-recognition that we use as naturalists and scientists every day. **"For years," Anderson would**

[16] Yi-Fu Tuan, *Topophilia: A Study of Environmental Perception, Attitudes, and Values* (Prentice-Hall, Inc., 1974), 93–94.

write later [48], "working with my students on hybrid populations of various kinds of plants, I maintained the attitude that any differences which could be seen could be measured or scored objectively, but that learning how to do this was a research problem in itself, sometimes very discouraging in its earliest stages."[17] Learning to see organisms and their differences, and learning to see the connections among organisms across time and space: however you define natural history, this is its soul.

When I imagine Anderson in the field [49] and think of what excites me today in my work as a botanist, teacher, herbarium director, and plant systematist, I see the confluence of observation, exploration, and inference from complex patterns both arising from and shaping stories. None of these elements of natural history is mine alone. Every naturalist I know employs them. But each of us is in a unique position to explore the landscape, draw inferences about the organisms that excite us the most, and ask why they are here. We all have expertise in some aspect of the grand story that connects organisms, whether we are focused on genes, populations, plots or communities, lineages, individual plants, ecosystems or landscapes. Many of us have direct access to and understand the importance of specimens, either through herbaria or through our research. We know how to explore landscapes at different scales and winnow the known from the vast pool of the unknown. We are practiced in hooking the unknown bits to something we do know to improve our understanding.

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[17] Edgar Anderson, "What We Do Not Know about *Zea Mays*," *Transactions of the Kansas Academy of Science (1903-)* 71, no. 3 (1968): 373–78, https://doi.org/10.2307/3627155.

And perhaps most importantly, we have the experience to recognize the gaps in our knowledge, and a delight in the not-yet-known [50]. Edgar Anderson, when introduced to audiences as an authority on corn, preferred to respond that he was not an authority on corn, but on what was not yet known about corn.[18] As naturalists, we have chosen this life of pecking away at the brightest, most exciting areas of our ignorance. We have a great opportunity to share this enthusiasm with students of all ages—from the preschoolers to their grandparents or even great-grandparents, who might well be volunteers in our herbaria. Natural history is empowering, because **it shows us with crystal clarity [51]** exactly what we and all the other brilliant people in the world don't know yet. Then it puts the onus on each of us to learn something new before we lose any more pieces.

There are still a few substantial tracts of forest near where Minnie Potter might have collected in Kane County in 1887, yielding the 52 specimens that sit in The Morton Arboretum herbarium today. I recently searched the main data portal for U.S. herbaria, SEINet, and found Kane County plant specimens from 68 institutional herbaria. **It appears there are exactly two herbarium specimens of goldenseal [52]** (*Hydrastis*) from Kane County: one collected by Minnie Potter in 1887, and one by Dick Young, author of the Flora of Kane County, in 1975. Both sit together in our herbarium, separated by 90 years.

[18] Ibid.

But there are 16 records of the species in iNaturalist [53] from 12 different observers, recorded over a 12-year span.[19] 20 iNaturalist users have jumped in to make suggestions on identification. The observers describe themselves as a natural resource specialist at Fermilab who volunteers as a plants-of-concern monitor and a forest preserve steward; a field botanist and ecological restorationist; "an all-around naturalist"; a science teacher; a plant ecologist and "at-large land steward"; an environmental interpreter; an "ok birder and former HS Science Olympiad herpetology champ who has forgotten just about everything"; the Vice president of the Illinois Native Plant Society Kankakee Torrent Chapter and volunteer plants-of-concern monitor; and three who have left their profiles at the anonymous "____ is a naturalist!" They appear to range from just out of school to post-career. Several have posted thousands of observations since joining iNaturalist. Three have posted more than 10,000.

Natural history—both the individuals-first approach to biology that starts with a passion for particular living organisms and the inference of histories from complex patterns—is far from dead [54]. But I think it could use some helping along. Today's world is complicated in new ways. Kids get outside on their own much less than they did a generation ago. Many experience the natural world online more often than they do in person.[20] Schools don't teach

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[19] https://www.inaturalist.org/observations?nelat=42.058762222580604&nelng=-88.22423972814649&subview=map&swlat=41.66658614847265&swlng=-88.5903934451875&taxon_id=118769 [accessed 2025-07-12].

[20] Based on interviews with 52 Anglo, Hisplanic, O'odham, and Yoeme (Yaqui/Mayo) children in summer of 1992, Gary Nabhan and his colleague Sara St. Antoine found that 77% of the Mexican kids, 61% of U.S. (non-Yaqui and non-O'odham), 60% of Yaqui, and 35% of O'odham kids "felt that they had seen more animals on television and in movies than they had personally seen in the wild." A 1992 survey of US 5th and 6th graders found that 53% reported media as their primary source of information about the environment; 31% reported school, 9% reported home or the wild. Nabhan and Trimble 1995, 87-88.

organisms like they used to. I was struck in reading Marston Bates' *The Nature of Natural History*, written in 1950, by this throw-away line: "There is probably no use in writing very much about the seed plants here. We all know the more obvious things about them, remembered from high school botany or picked up at meetings of the Garden Club."[21] I was born only 20 years after he published those lines, but none of my peers had a high school botany course. I left high school seeing plants as a vaguely distinguished cloud of green. My experience is hardly unique. In 2015, Andrea Kramer and Kay Havens demonstrated "severe shortages of botanists" and "alarming declines" in basic botanical education.[22] The students I work with in our local high school have an exceptionally strong science department that embraces and put resources into hands-on science education. Yet the only botany most of the students learned is wedged into their AP biology or environmental science curriculum, packed in around the core requirements. Most don't even take these courses.

People want a natural history community nonetheless [*5 images, work through paragraph – Stop with Socorro and Tony and Jesús and Lizeth et al. in Durango, 2015*] [55—59]. We see it in the growth of iNaturalist not just a place to deposit your photos, a natural-history analogue to flickr, but also as a joyous and serious running dialogue about what species are, which ones people have found, and their proper names. People come out for lectures on the natural history of trees. Natural history writing is alive and well. Robin Wall Kimmerer,

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[21] Marston Bates, *The Nature of Natural History* (Princeton University Press, 1950), 32.

[22] Andrea T. Kramer and Kayri Havens, "Report in Brief: Assessing Botanical Capacity to Address Grand Challenges in the United States," *Natural Areas Journal* 35, no. 1 (2015): 83–89, https://doi.org/10.3375/043.035.0112.

Robert Macfarlane, J. Drew Lanham, Arati Kumar-Rao, Edwardo Kohn, Theresa Crimmins, Douglas Tallamy and scores of others are writing popular books about topics that are kind of niche: phenology, mosses, oak ecology, landscape history, the land ethic, what it means to say that a forest is alive. The fact that people are reading these books suggests that there is a natural history urge that is far from languishing.

The organisms that we love and the complex weave that makes the ecosystems in which they thrive are nonetheless at risk [60]. An essential part of saving what we have is ensuring that people know it. We all have a lot on our plates, but if we all in this room do just one new thing in the coming year to support the stories, the specimens, the exploration of the world, the habits of observation and inference that are natural history's unique peculiar advantages, we can strengthen the entire natural history community. And to our whole community of naturalists, I ask this: **can we each bring one new member into our community and society [61]** in the coming year, someone working on their own who may not even know that there *is* such a community?

Yi-Fu Tuan closes his book *Topophilia* with these words: "**All humans are well-equipped biologically and register a vast array of environmental stimuli [62]**. Most people go through their lives making only very limited demands on their perceptual powers."[23] As a community of naturalists working in a range of disciplines—education, communication, ecology, systematics, restoration, conservation, horticulture, structural botany, physiology, genomics—we are

[23] Tuan, *Topophilia: A Study of Environmental Perception, Attitudes, and Values*, 245.

responsible for creating a culture in which all of our senses are honed. **We can help keep the gates of perception open and the wheels of inference rotating freely [63]**. The more clearly and deeply we perceive, the richer our world and the broader our worldview. Why do it? Because attuned sensation is the root of empathy: being clear about what we perceive and feel, and then imagining what others perceive and feel and how it affects them.

You may have noticed that I haven't yet given you an answer to the question [64], "how do we teach natural history?" Anderson didn't either. He modeled it. The practices of natural history carry into and beyond the knowledge of animals from their tracks and the identification of sedges. Our calling as naturalists is to learn and share these practices for what they can teach us about living in this world and making it better.

Thank you [65].

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References cited

Anderson, Edgar. "Efficient and Inefficient Methods of Measuring Specific Differences." *Statistics and Mathematics in Biology*, Iowa State College Press Ames, Iowa, 1954, 93–106.

Anderson, Edgar. *Introgressive Hybridization*. John Wiley & Sons, Inc., 1949.

Anderson, Edgar. "Natural History, Statistics, and Applied Mathematics." *American Journal of Botany* 43, no. 10 (1956): 882–89. https://doi.org/10.2307/2439005.

Anderson, Edgar. "What We Do Not Know about *Zea Mays*." *Transactions of the Kansas Academy of Science (1903-)* 71, no. 3 (1968): 373–78. https://doi.org/10.2307/3627155.

Anderson, Edgar, and Leslie Hubricht. "Hybridization in *Tradescantia*. III. The Evidence for Introgressive Hybridization." *American Journal of Botany* 25, no. 6 (1938): 396–402. https://doi.org/10.2307/2436413.

Anderson, Edgar, and Thomas W. Whitaker. "Speciation in *Uvularia*." *Journal of the Arnold Arboretum* 15, no. 1 (1934): 28–42.

Arnold, Stevan J. "Too Much Natural History, or Too Little?" *Animal Behaviour* 65, no. 6 (2003): 1065–68. https://doi.org/10.1006/anbe.2003.2143.

Basso, Keith H. "'Stalking with Stories': Names, Places, and Moral Narratives among the Western Apache." In *On Nature: Nature, Landscape, and Natural History*, edited by Daniel Halpern. North Point Press, 1987.

Bates, Marston. *The Nature of Natural History*. Princeton University Press, 1950.

Eberbach, Catherine, and Kevin Crowley. "From Everyday to Scientific Observation: How Children Learn to Observe the Biologist's World." *Review of Educational Research* 79, no. 1 (2009): 39–68. https://doi.org/10.3102/0034654308325899.

Greene, Harry W. "Organisms in Nature as a Central Focus for Biology." *Trends in Ecology & Evolution* 20, no. 1 (2005): 23–27. https://doi.org/10.1016/j.tree.2004.11.005.

Hampton, Stephanie E., and Terry A. Wheeler. "Fostering the Rebirth of Natural History." *Biology Letters* 8, no. 2 (2011): 161–63. https://doi.org/10.1098/rsbl.2011.0777.

Heiser, Charles B. "Edgar Anderson, Botanist and Curator of Useful Plants." *Annals of the Missouri Botanical Garden* 82, no. 1 (1995): 54–60. https://doi.org/10.2307/2399980.

King, Heather, and Marianne Achiam. "The Case for Natural History." *Science & Education* 26, no. 1 (2017): 125–39. https://doi.org/10.1007/s11191-017-9880-8.

Kleinman, Kim. "From Geneticist to the Garden to Senior Botanist: Edgar Anderson and the Study of Plants in the 20th Century." *Annals of the Missouri Botanical Garden* 105, no. 4 (2020): 578–87. https://doi.org/10.3417/2020444.

Kramer, Andrea T., and Kayri Havens. "Report in Brief: Assessing Botanical Capacity to Address Grand Challenges in the United States." *Natural Areas Journal* 35, no. 1 (2015): 83–89. https://doi.org/10.3375/043.035.0112.

McGlynn, Terrence P. "Natural History Education for Students Heading into the Century of Biology." *The American Biology Teacher* 70, no. 2 (2008): 109–11. https://doi.org/10.1662/0002-7685(2008)70[109:NHEFSH]2.0.CO;2.

McKeon, Seabird, Louise Weber, Andrea J. Adams, and Thomas L. Fleischner. "Human Dimensions: Natural History as the Innate Foundation of Ecology." *The Bulletin of the Ecological Society of America* 101, no. 1 (2020): e01656. https://doi.org/10.1002/bes2.1656.

Nabhan, Gary, and Stephen Trimble. *The Geography of Childhood: Why Children Need Wild Places*. Beacon Press, 1995.

Noss, Reed F. "The Naturalists Are Dying Off." *Conservation Biology* 10, no. 1 (1996): 1–3.

Oliver, Mary. *A Poetry Handbook: A Prose Guide to Understanding and Writing Poetry*. Houghton Mifflin Harcourt, 1994.

Pyle, Robert Michael. "The Rise and Fall of Natural History." *Orion: People and Nature* 20, no. 4 (2001): 16–23.

Pyle, Robert Michael. *The Thunder Tree: Lessons from an Urban Wildland*. Oregon State University Press, 2011.

Sampson, Scott Donald. "The Topophilia Hypothesis: Ecopsychology Meets Evolutionary Psychology." In *Ecopsychology: Science, Totems, and the Technological Species*, edited by Peter H. Kahn Jr. and Patricia H. Hasbach. MIT Press, 2012.

Stebbins, G. Ledyard. "Edgar Anderson." *National Academy of Sciences: Biographical Memoirs* 49 (1978): 3–23.

Trombulak, Stephen C, and Thomas L Fleischner. *Natural History Renaissance*. n.d.

Tuan, Yi-Fu. *Topophilia: A Study of Environmental Perception, Attitudes, and Values*. Prentice-Hall, Inc., 1974.

Van Stan, John T, Scott T Allen, Douglas P Aubrey, et al. "Shower Thoughts: Why Scientists Should Spend More Time in the Rain." *BioScience* 73, no. 6 (2023): 441–52. https://doi.org/10.1093/biosci/biad044.

Yee, Gary, and Michael Kirst. "Lessons from the New Science Curriculum of the 1950s and 1960s." *Education and Urban Society* 26, no. 2 (1994): 158–71. https://doi.org/10.1177/0013124594026002004.

Zwinger, Ann. "A World of Infinite Variety." In *On Nature: Nature, Landscape, and Natural History*, edited by Daniel Halpern. North Point Press, 1987.