

Journal of NATURAL SCIENCE ILLUSTRATION

GUILD OF NATURAL SCIENCE ILLUSTRATORS



Note from the Editor

Visual science communication has the potential to be a great unifier—in each illustration or infographic, we draw the connections between human health, ecosystem health, economic health, and social justice. Each time we publish #sciart, we send ripples far and wide, inspiring catalytic change.

We're living through a profoundly challenging moment in our history, where education and science are being challenged by fear and disinformation. For too long, scientists and academics have relied heavily on text-based publications with few or poorly designed visuals to communicate their findings. Simply sharing knowledge is no longer enough. In today's information age, scientific content needs to be immediately compelling, engaging, and accessible, and build trust, empowerment, and belonging. Custom visualizations check all the boxes—sharing information in "nonthreatening ways, such as by adding culturally sensitive, emotionally moving, and/or entertaining content" (pg. 7). The best science illustrations don't just dispense information; they engage viewers on a gut emotional level, e.g., with visual storytelling or by making abstract concepts more relatable or "close to home." Illustrations also provide much-needed relief from information and photo overload (or scrolling fatigue).

This issue is filled to the brim with beautiful illustrations, including a gallery of student works from CSUMB's 2024 Science Illustration class, and sketches of bears (on location!) from Bea Martin's artist-in-residency in Alaska's Kootznookoo Wilderness. We share an excerpt from *Visuals as a Catalyst for Climate Science Communication*, written by 5 GNSI members, emphasizing the critical importance of including visual science communicators on communication teams. Finally, we shine a spotlight on our new GNSI president, Deb Haines, and her career as a medical and veterinary science illustrator. Also tucked into these pages: A preview of GNSI's 2025 Visual SciComm Conference. For the first time since the pandemic, we're meeting in person again. Join us at Bridgewater University in Massachusetts, July 13th–19th. Network with your colleagues, learn new skills, and get inspired!

—Fiona Martin, Managing Editor

CONTENTS

Editor's Note, by Fiona Martin	2
Sketching On Location, by Bea Martin	3–4
Visuals as a Catalyst for Climate Science Communication, Part 1 by Kalliopi Monoyios, Kirsten Carlson, Taina Litwak, Tania Marien, and Fiona Martin	5–16
Illustrating Nature: CSUMB Science Illustration Graduate Program Class of 2024, by Emma Regnier and Karin von May	17–22
A Look Ahead at the 2025 Visual SciComm Conference, by Stephen DiCerbo	23–26
Member Spotlight, by Deborah K. Haines, GNSI President	27–31

Cover: Life in a Vernal Pool. Eastern ribbon snake (*Thamnophis saurita*), ringed boghaunter (*Williamsonia lintneri*), spotted turtle (*Clemmys guttata*), wood frog (*Lithobates sylvaticus*), eastern newt (*Notophthalmus viridescens*), spotted salamander (*Ambystoma maculatum*), and astern fairy shrimp (*Eubranchipus vernalis*). Mixed media on hot press. © 2024 Lauren Richelieu, she/her

Back cover: GNSI Visual SciComm Conference call for volunteers and registration information

NATURAL SCIENCE ILLUSTRATORS



The Guild of Natural Science Illustrators is a nonprofit organization devoted to providing information about and encouraging high standards of competence in the field of natural science illustration. The Guild offers membership to those employed or genuinely interested in natural scientific illustration.

GNSI GENERAL INFORMATION

MEMBERSHIP

USA Print: \$95/year (\$180 for two years)

Global: \$115/year (\$220 for two years)

Digital Delivery: \$75/year (\$145 for two years)

Portfolio+ gallery upgrade: add \$65/year to membership

Other membership options are available; see website. Secure credit card transactions can be made through www.gnsi.org. Or send checks made out to "GNSI" at the address below. Please include your mailing address, phone, and email.

CONTACT

General Inquiries: info@gnsi.org

Journal: journal@gnsi.org

News and Announcements: news@gnsi.org

Membership Questions: membership@gnsi.org

WEB & SOCIAL

Stay up-to-date with all GNSI happenings at www.gnsi.org and through our monthly newsletter. Here you can update your member information, find announcements about members' accomplishments, information about our annual Visual Science Communication Conference, Education Series workshops, and more. You can also find GNSI on Facebook at @GNSIart or GNSI Members, Bluesky at bsky.app/profile/gnsiart.bsky.social, LinkedIn, and Discord.

GNSI JOURNAL

Volume 57, Number 1/2025 • © 2025

JOURNAL OF NATURAL SCIENCE ILLUSTRATION (JNSI) (ISSN 01995464) is published at 2201 Wisconsin Ave., NW, Suite 320, Washington, DC 20007, by the Guild of Natural Science Illustrators, Inc.

This paper meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).

POSTMASTER: CHANGE OF ADDRESS

Send notices to: info@gnsi.org

GNSI JOURNAL SUBMISSION REQUIREMENTS

gnsi.org/jnsi-author-guidelines

JNSI STAFF

Managing Editor: Fiona Martin

Senior Consulting Editor: Britt Griswold

Layout Manager: Sarah McNaboe

Layout Designer: Autumn Von Plinsky

Copy Editors: Kathleen Garness, Anna McGaraghan,

Julianne Snider, Cheryl Wendling

Technical Editor: Caitlin O'Connell

Post-Production: Jennifer Lucas, Olivia Ambrogio, Jen Wang

GNSI Outreach Director: Bruce Worden

Guest Proofreader: Janet Griswold

Sketching On Location

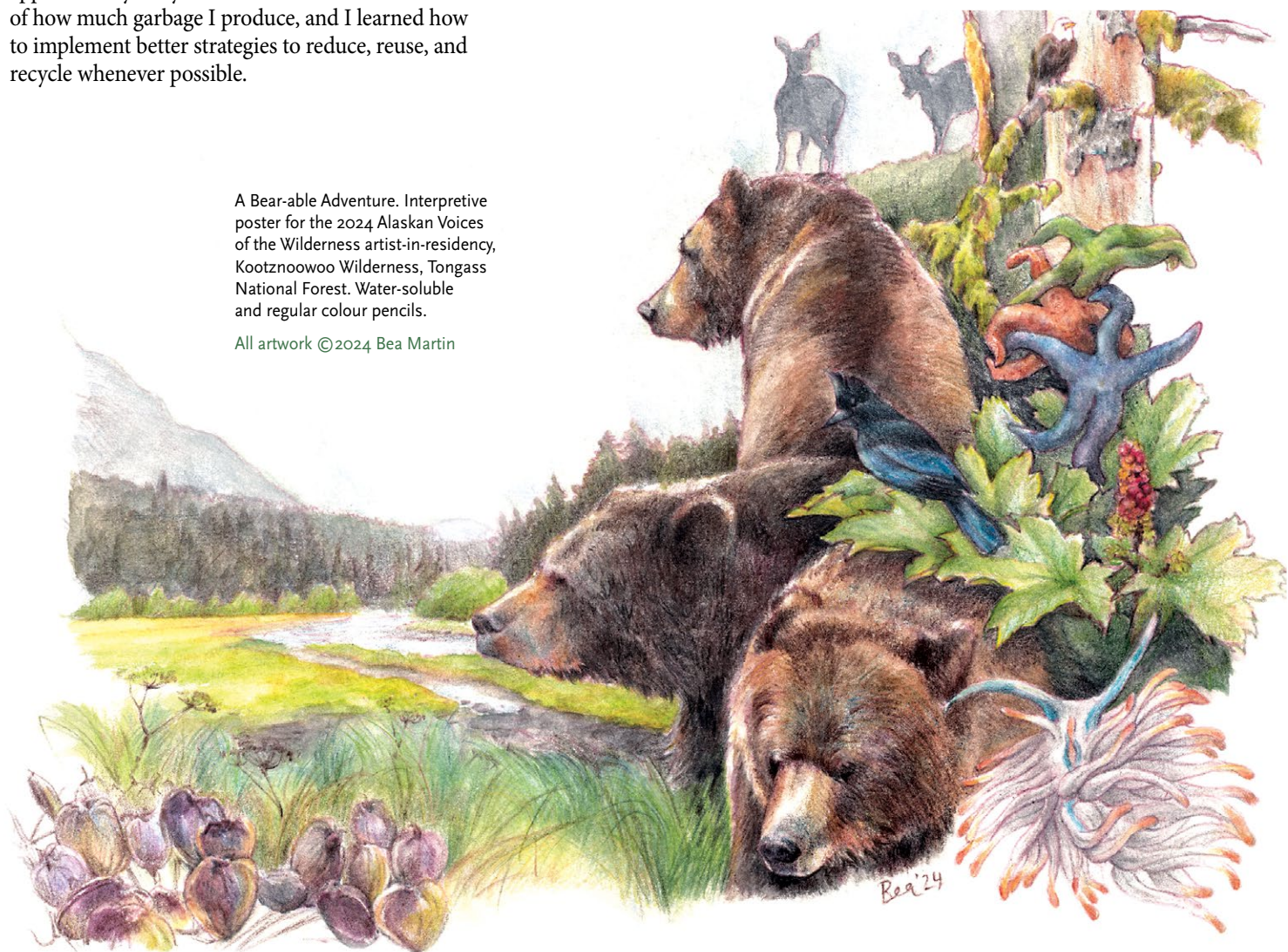
Bea Martin

During my time in the Alaskan Voices of the Wilderness artist-in-residency program, I used my portable on-location sketching kit that includes graphite, colour pencils, and gouache. This “minimal equipment” approach plus the use of environmentally friendly cleaning practices relates to my goal of making my artistic practice sustainable and respectful to my surroundings.

I welcomed being completely off the grid and disconnecting from every single daily stressor. I realised how much I had taken limited resources for granted, like water. I learned about many environmentally sustainable practices, which I then applied in my daily life at home. I also became aware of how much garbage I produce, and I learned how to implement better strategies to reduce, reuse, and recycle whenever possible.

A Bear-able Adventure. Interpretive poster for the 2024 Alaskan Voices of the Wilderness artist-in-residency, Kootznoowoo Wilderness, Tongass National Forest. Water-soluble and regular colour pencils.

All artwork ©2024 Bea Martin

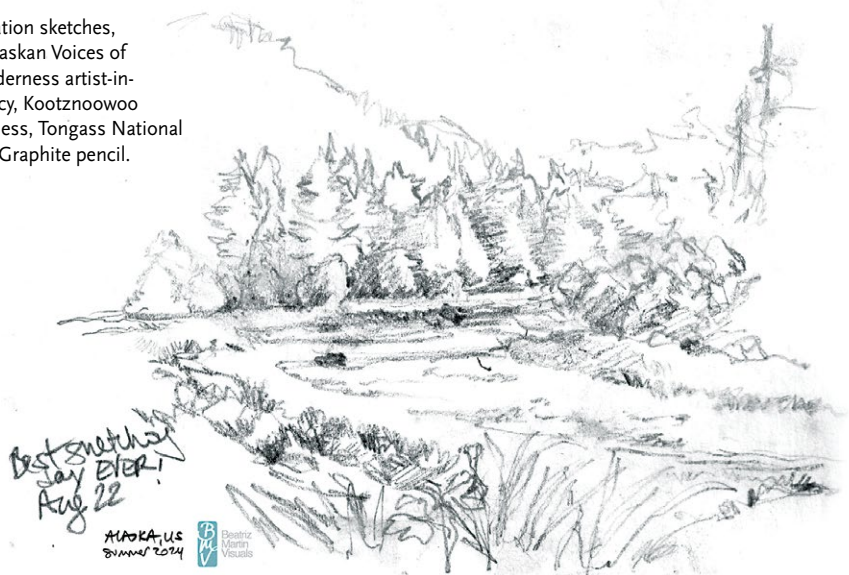


My Goals for the Residency

These were my goals as a professional artist and visual storyteller:

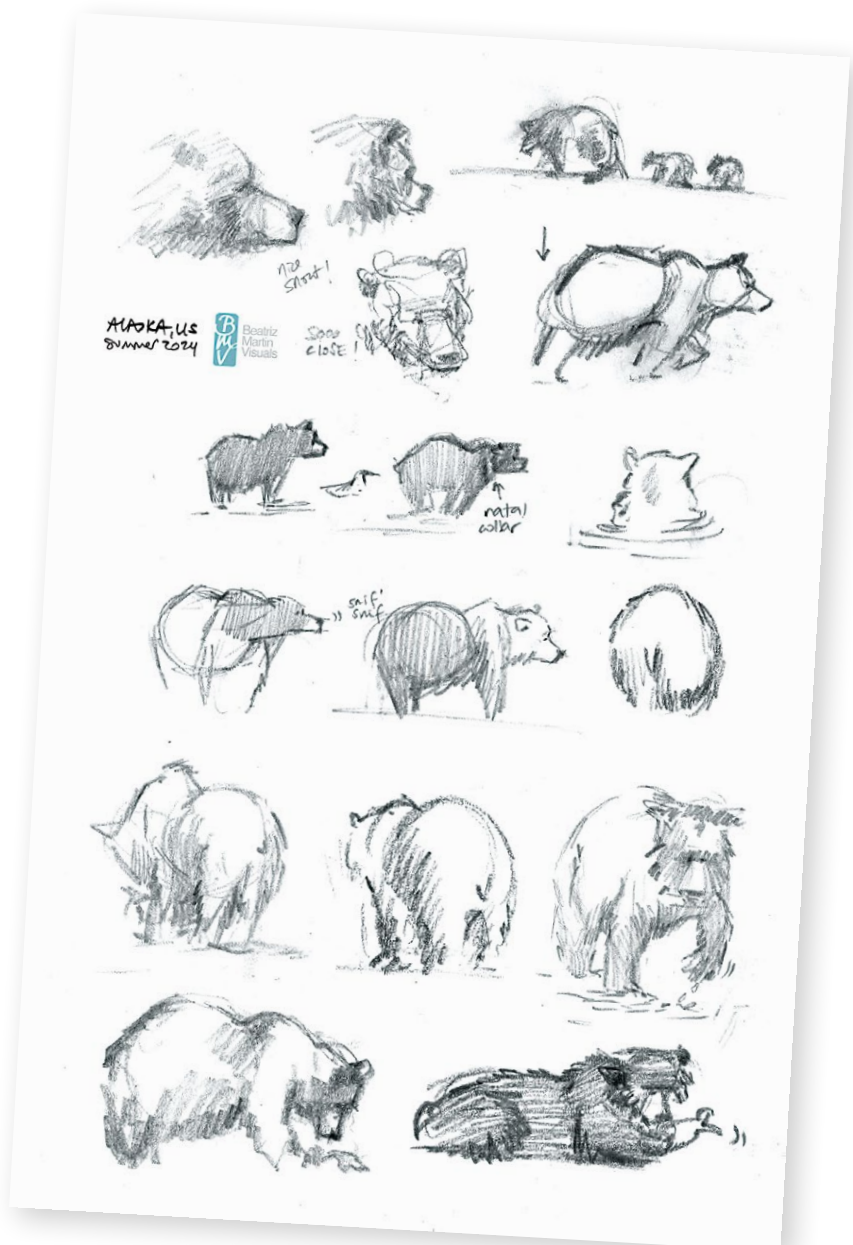
- Sketch daily on location
- Practice observation and sketching of nature with the aid of binoculars
- Practice nature journaling, adding annotations, observations, questions, thoughts, and memories
- Disconnect from daily stressors (phone, email, news, etc.)
- Connect with nature, develop mindfulness
- Learn new skills and apply existing ones to assist and help my hosts
- Grow and share my appreciation for Alaskan natural parks through my art

On-location sketches, 2024 Alaskan Voices of the Wilderness artist-in-residency, Kootznookoo Wilderness, Tongass National Forest. Graphite pencil.



ABOUT THE ARTIST

Bea Martin is a Canadian visual storyteller and the recipient of the 2024 Richmond Arts Award in Arts Education. Bea Martin's unique approach to arts education is the result of a multidisciplinary background as a character animator, theatre improviser, nature sketcher, certified medical illustrator (CMI), Fulbright Scholar, and medical doctor. bmartinvisuals.wordpress.com



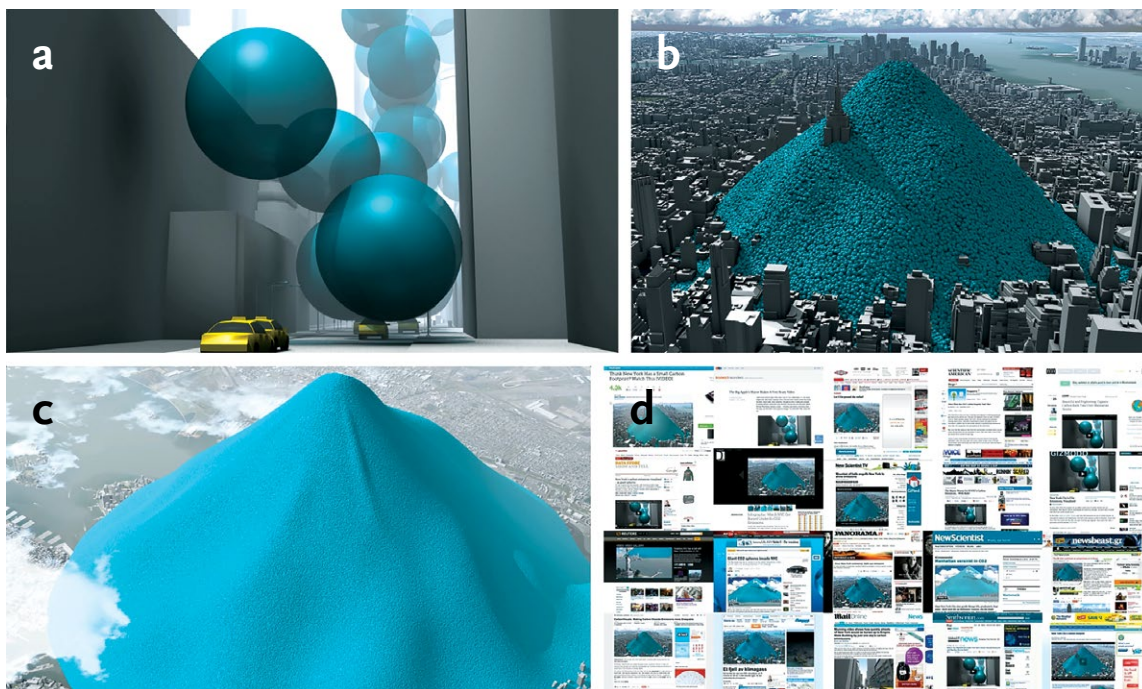
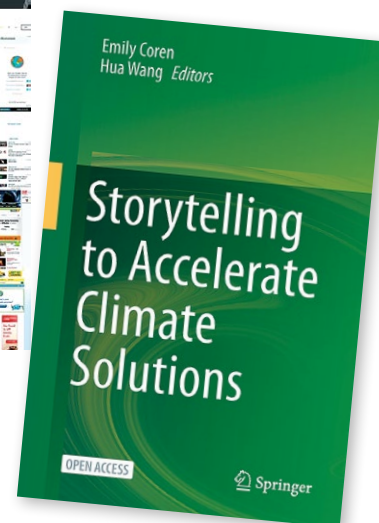


Figure 1: Stills from the animated sequence “Carbon Emissions in New York in 2010.” (a) Each 33-foot sphere represents 1 metric ton of CO₂ emissions. (b) Daily emissions. (c) Annual emissions. (d) Collage of some of the >100 articles and blogs featuring the images and animation. © 2021 Real World Visuals



Above: Cover of the open-access book *Storytelling to Accelerate Climate Solutions*, edited by Emily Coren and Hua Wang and published by Springer. ISBN: 978-3-031-4789-8; eBook: <https://link.springer.com/book/10.1007/978-3-031-54790-4>

Visuals as a Catalyst for Climate Science Communication

PART 1: WHAT VISUAL SCIENCE COMMUNICATORS BRING TO THE SCICOMM TABLE

— by Kalliopi Monoyios, Kirsten Carlson, Taina Litwak, Tania Marien, and Fiona Martin

*The following pages contain excerpts from a chapter written by four GNSI members and published in the open-access book, *Storytelling to Accelerate Climate Solutions*. In Part 1, we break down the many fronts on which visual collaborations can effectively push climate science forward. We are here, with our sleeves rolled up, ready to work with scientists, policymakers, and communications teams on the critical work of climate communication.*

If someone told you that your city produced 54 million tons of carbon dioxide gas each year in emissions, you might be impressed. But then you would realize you really have no idea what 54 million tons of gas looks like—is that a lot? A little? Is that concerning? And you’re suddenly lost. In 2012, a data visualization firm called Real World Visuals and the Environmental Defense Fund recognized this as an opportunity to experiment with how they could make this very statistic, the annual CO₂ emissions for New

York City, instantly understood by audiences “who don’t know they need to know” (Fig. 1).¹ Their brilliant solution was to translate the volume of a single metric ton of carbon dioxide gas into a large blue sphere measuring 33 feet across. They then animated the streets of New York as these spheres accumulate at the rate of one per 0.58 seconds. A single day’s emissions form a pile of spheres roughly the height of the Empire State Building. Eventually, one year’s worth of carbon emissions forms an imposing mountain

STAY TUNED for Part 2 where we will share tips for creating more effective climate visuals.

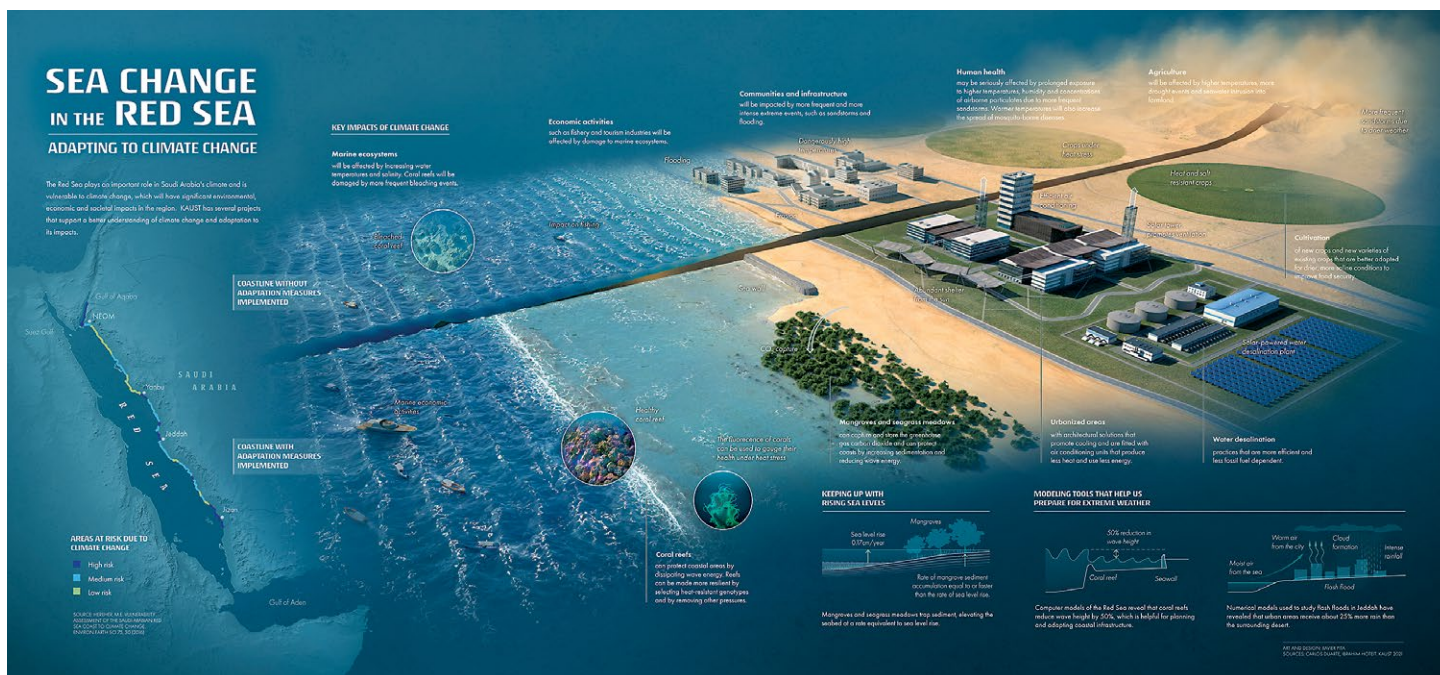


Figure 2: In this sweeping depiction of how rising sea levels will affect the Red Sea coastline, visual science communicator Xavier Pita literally brings a solution-minded approach to the fore by illustrating two scenarios—how the coastline might change if we invest in infrastructure adaptations (*front*) and what we might face if we do nothing (*back*). In this way, Pita unpacks the suite of changes that may or may not unfold in the complex interplay of climate change and mitigation efforts. ©2021 Xavier Pita/ King Abdullah University of Science and Technology

of blue balls covering Manhattan Island. Since its publication, the animation has been cited in over 100 articles and blogs and viewed over 400,000 times on YouTube.² Carbon Visuals and the Environmental Defense Fund could have simply shared the numbers with the world: 54,349,650 metric tons of carbon dioxide added to the atmosphere by New York City in 2010—that’s 148,903 tons a day, 6,204 tons an hour, and 1.72 tons a second. But they would have lost most of us who aren’t accustomed to dealing with large numbers and/or who don’t have a working concept of how much gas weighs (beyond “very little”).

Their great insight was that we are visual animals. Making the invisible visible was all that was needed to get an important point across about the untenable rate of greenhouse gas emissions coming from New York. And we can look to the overwhelmingly positive media response and high engagement numbers on YouTube as evidence of the potential for great visuals to carry science messages far and wide.²

The success of Carbon Visuals’ animation was no accident. Their creatives have backgrounds in both art and science. They are able to delve into the details of the science without intimidation and then zoom out to apply their understanding of how people see things to create visuals that are intuitive and striking. They are quintessential examples of what we call *visual science communicators*.

FROM SCIENCE ILLUSTRATION TO VISUAL SCIENCE COMMUNICATION

Science illustrators comprise a specialized group with advanced training in both science and art. Their work

has been, until recently, primarily descriptive with most of their efforts spent documenting the anatomy of plants and animals. Traditional science illustration work goes back well beyond the Renaissance and scientists/artists like Leonardo da Vinci (d. 1519), human anatomists like Andre Vesalius (d. 1564), and botanical artists like Leonhart Fuchs (d. 1566), to the exacting botanical paintings of Xu Xi (China, d. 975) and the painters of the Tomb of Nebamun (Egypt, 1350 BCE). You’ll recognize contemporary practitioners’ work in medical settings (patient pamphlets and doctors’ offices), in resources like birding books, specialty science journals, and popular science magazines.

As science advances into understanding more and more of what cannot be seen easily, or seen at all, traditional scientific illustration is changing too. It has become a valuable method of conveying complex concepts like minute cellular and molecular structures and biochemical mechanisms and processes (see, for example, Jennifer Fairman’s spectacular depictions of SARS-CoV-2 done for the Johns Hopkins medical community at the height of the pandemic and Mesa Schumacher’s spread for *National Geographic* on viruses in general).^{3,4} At the other extreme of the scale of scientific exploration, it is an invaluable tool for describing the vastness of space and our understanding of the physics of the universe (see space artists such as Mark Garlick and Lynette Cook). Of critical importance to us at this moment in history, it can also be used to illustrate complex systems and how they work, as in Xavier Pita’s masterfully executed tableau titled “Sea Change in the Red Sea; Adapting to Climate Change” (Fig. 2).

In these cases, what a select few scientists can view directly with highly specialized equipment or understand via complex calculations is made accessible to much larger audiences with images that feel intuitive and real. Creating these illustrations requires a significant understanding of the science and the ability to translate and crystallize complex information into an image that tells the story and can be readily understood.

Reflecting this change in how science has advanced, the skill set of science illustrators has also changed in stride to stay relevant. Consequently, many science illustrators have adopted the title “Visual Science Communicator” to more accurately reflect the broad array of visual art tools and science communication skills they have at their disposal. Visual science communicators typically have formal training in both science and art, which results in a unique combination of skills: a high level of understanding of the science and the ability to distill and communicate that information visually. They excel at telling engaging stories through well-designed graphics and illustrations that appeal to wide and varied audiences. These are the people who are critical to establishing a robust catalog of imagery that accurately and effectively conveys the seriousness of our climate situation and spurs policymakers and the public to act swiftly and decisively.

I work with some of the best science communicators in the world, and I see how hard they have endeavored to hone their craft. This is a profession and a full-time job—not something that can be picked up in a workshop.

—H. HOLDEN THORP, EDITOR IN CHIEF, SCIENCE JOURNALS ⁵

WHY ARE VISUALS MORE EFFECTIVE THAN WORDS ALONE?

With the proliferation of the Internet, smartphones, and ubiquitous online publishing, information is more accessible than ever. Our attention has become a valuable commodity, with advertisers finding more ways to monopolize it and monetize it.⁶ As a result, accurate information has a tougher slog to break through the never-ending scrolling we engage in, and people increasingly ask the question “why should I care?” or “what can I possibly do about it?” when confronted with challenging scenarios. We need tools to compete effectively, engage viewers,

and inspire action. Visuals—particularly those with a narrative bent that engage our emotions and trigger the neurotransmitter oxytocin—are a powerful tool to harness in this pursuit.⁷

A striking characteristic of human memory is that pictures are remembered better than words.

—GRADY ET AL., 1998 ⁸

Research supports the assertion that visuals add to the impact of scientific endeavors by improving dissemination and deepening engagement.^{9,10} Aside from the anecdotal evidence members of the general public can easily conjure (e.g., school textbooks chock full of explanatory figures, museum displays employing heavy use of two-dimensional and three-dimensional visuals, and a nearly endless supply of social media feeds populated with eye-catching imagery), studies suggest that when put into the world with imagery, original scientific papers enjoy more engagement on social media platforms than papers that are posted without.^{9,11} Simply put, using effective imagery translates to increased visibility for scientists’ research. The value in increased visibility need hardly be argued among researchers, but it begs the question: How does this ultimately translate to a better informed and engaged public, particularly on the vexing problem of implementing climate change solutions?

For one, images are processed differently than words and seem to engage the memory centers of the brain more directly.⁸ Furthermore, imagery that is novel and/or triggers emotions can heighten attention and memory in ways that words cannot.^{7,8,10} After all, there’s only one way to write the word “water” but near-infinite ways to depict it visually. In this way, images can serve as a universal communication tool reaching beyond language and education barriers.⁷ They can communicate large data sets and real-world impacts “at a glance” (e.g., weather patterns), allowing easier comparison of findings. And they have the power, as with infographics, to mitigate information overload by visualizing findings and solutions in more succinct and appealing ways.¹²

When paired with storytelling principles, images can invite viewers along for a ride, increasing their sense of empowerment and belonging. This often entails utilizing artistic techniques that evoke feelings in a viewer, ideally allowing the transfer of information in nonthreatening ways, such as by adding culturally sensitive, emotionally moving, and/or entertaining content.^{12,13} Neuroscientific studies have shown

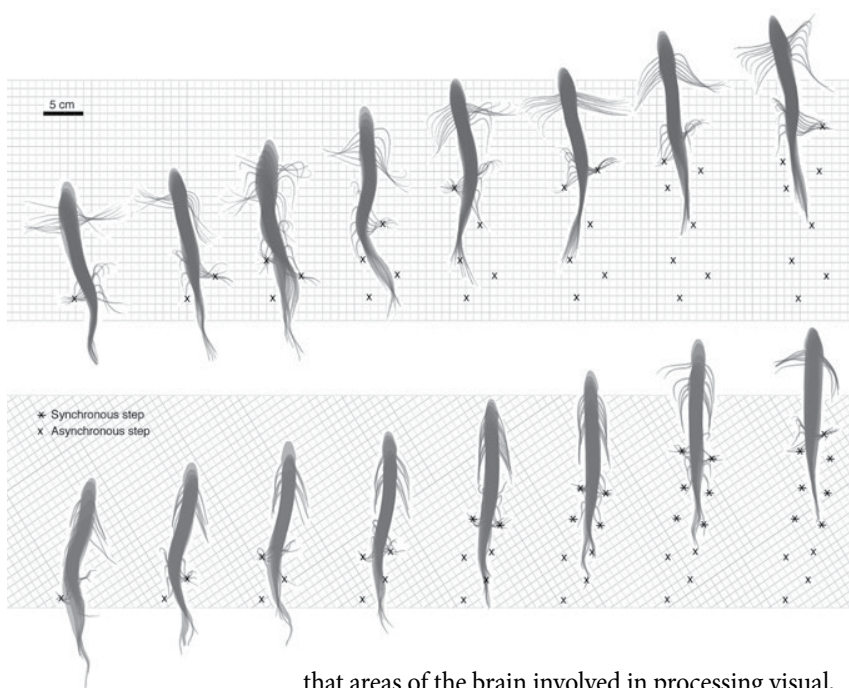


Figure 3: Lungfish Walking. Working with a departmental scientific illustrator led the lead researcher, Heather King, to consider designing force plate experiments she hadn't previously considered. ©2011 Kalliopi Monoyios (King et al., 2011)

that areas of the brain involved in processing visual, esthetic, and emotional stimuli—the prefrontal cortex, orbitofrontal cortex, amygdala, and insula (the limbic system)—are closely linked to learning and memory, as well as decision-making under social pressure.¹⁰ All of these aspects give visual science communication an outsized role in educating the public and spurring societal change.

RESEARCH PUBLICATIONS AND ACADEMIC TRAINING

There are many situations in which academics working on climate research could take better advantage of the power of visual science communication. Poster sessions—where research results are displayed visually with text and graphics—have been integral parts of scientific conferences for decades. Yet the concept of submitting a graphical abstract, also known as a visual abstract, to be shared in online settings where scientists convene is relatively new.⁹ Despite the widespread adoption of graphical abstracts in at least 75 medical journals,¹⁴ a quick survey of author guidelines for the top journals publishing *climate science* reveals no mention of graphical abstracts to promote engagement or dissemination of critical research.

In the current landscape, without access to staff visual science communicators, researchers' graduate students, lab techs, and postdocs—who are often not interested in or able to provide satisfactory graphics for their papers—may resort to repurposing old publication graphics. If a repurposed diagram is not laser-focused on communicating the author's intent, it fails to inform quickly and seamlessly and risks losing the viewer altogether. In teaching, this is particularly important, but nowhere is it more

important than on social media, where scientific conversations and informal learning are increasingly happening.¹⁴ Ibrahim et al. (2017) found that adding quality graphics to social media posts about scientific research led to higher impact factors for published papers and greater reach in the scientific community, the news media, and beyond.⁹ It follows that dedicating resources to at least one visual science communicator in an academic department, or even one position shared across closely related departments (where budget constraints are real), is well worth the investment.

External impacts are not the only benefits of working with a good visual science communicator. Working with someone who brings a different set of skills and perspectives to the workspace can allow researchers to see their work in new ways and even open new lines of inquiry.¹⁵ Good visual storytelling can make potentially inaccessible research sing, inspiring students and colleagues to pursue new lines of research that suddenly spark their interest. It can also reveal patterns in the data, clarify thinking, and/or expose areas in which further research is needed. In one example, Kalliopi Monoyios, working as a staff illustrator at the University of Chicago, was given video footage of African lungfish engaging in a walking behavior and was tasked with finding an elegant way to show the novel fin locomotion for publication in two-dimensional media. By illustrating stills from the video footage (Fig. 3), Monoyios created a stacked time-lapse depiction of the walking movement that highlighted pivot points around which the lungfish was propelling itself forward. This visual prompt in turn sparked new questions for the researcher as she pondered whether future experiments could quantify how much force was exerted with each “step.”¹⁶ It is well accepted that having diverse perspectives in a boardroom leads to better business outcomes; the same holds true for scientific laboratories.

PUBLIC OUTREACH BY GOVERNMENTAL AND NONGOVERNMENTAL ORGANIZATIONS

It is important that government agencies—with their vast collection of scientific teams doing critical research on climate change and solutions—use effective visual storytelling to engage with the public. Likewise, nongovernmental organizations (NGOs) such as nonprofits, social movements, and citizen science groups can amplify their efforts to combat climate change complacency with quality support from visual science communicators. At the time of this writing, the Intergovernmental Panel on Climate Change¹⁷ report warns that the earth will warm between 2°C and 6°C (3.6°–10.8°F) over the next century. In many regions, warming has already surpassed 1.5°C above preindustrial levels. The U.S.



National Intelligence Council Report¹⁸ predicts the impacts of climate change—rising temperatures, extreme weather, droughts, food insecurity, health risks, and conflict—will accelerate trends of massive migration and global instability within the next 20 years. Obviously, getting these types of academic findings seen and understood on a personal, even emotional level, by the largest possible audience is critical. We have little time to act if we are to assist governments and NGOs in the swift, decisive action that is warranted. In the U.S., 13 federal agencies, including the Environmental Protection Agency (EPA), the National Science Foundation (NSF), the National Oceanic and Atmospheric Association (NOAA), the Department of Defense (DOD), and the Department of Agriculture (USDA), worked on the 2018 *Climate Change Report*. All these agencies had communications departments staffed with quality journalists and “visual information specialists.” They

are not staffed with “scientific illustrators” (a different U.S. government job description series), and there is no official classification for visual science communicators. Without a formal category for specialists combining science degrees with visual communication skills, federal agencies risk hiring candidates who may unintentionally misconstrue the science and/or fall short of motivating decision-makers and the public to take action. Clearly, there is a need to create staffing structures within the communications sections of government agencies that specify an appropriate skill set for producing scientific graphic communication.

“Existing communications teams are too dependent on stock images,” says Taina Litwak, who at the time of this writing, is the sole staff scientific illustrator we are aware of for the USDA, a collection of 29 units employing over 100,000 people. While stock photos

Figure 4: This very detailed visual, “The Future of Work at the Human–Technology Frontier,” was created for the National Science Foundation by Nicolle R. Fuller during her work as a contractor there. It’s a good example of the depth and breadth of a story that can be told with quality narrative scientific illustration. ©2021 Nicolle R. Fuller/ National Science Foundation

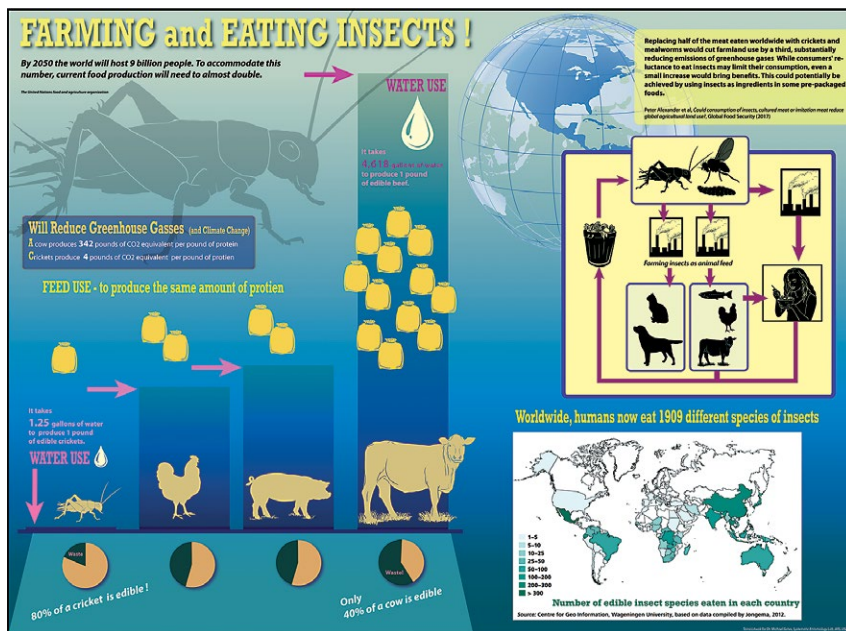


Figure 5: To the best of our knowledge, the USDA, a collection of 29 agencies employing over 100,000 people, has one staff scientific illustrator position. She produced this poster, “Farming and Eating Insects,” to promote a more sustainable alternative to traditional animal protein sources. This poster is used for public educational presentations by USDA staff. Illustration by Taina Litwak/ USDA, in the public domain.

can sometimes approximate what you are trying to say or establish an overall tone, rarely do they convey the context and nuance that make a scientific revelation stand out. And context and nuance are critical elements of effective graphics, according to Jen Christiansen, Senior Graphics Editor at *Scientific American*.¹⁵

We also see missed opportunities and heavy reliance on stock imagery in information-heavy emails from top NGOs such as Friends of the Earth Action, Center for Biological Diversity, National Audubon Society, Climate Hawks Vote, the Climate Reality Project, the Nature Conservancy, Sierra Club, and 350.org. They are largely devoid of visual storytelling and tend to feature a sympathetic photo or two (often featuring the poster child of climate change imagery: polar bears) as a decorative afterthought to the salient information packed into the prose. These NGOs are working hard to make the world aware of the urgency of climate change and are instigating and advocating for widespread action. Yet, they could use visual storytelling to much greater effect.

If a story does not sustain our attention, then the brain will look for something else more interesting to do.

—ZAK, 2015⁷

Not all climate advocates are reliant on stock photography, however. Some government agencies are already harnessing the power of visual science communication professionals either as full-time staff or, more commonly, independent contractors. NOAA’s

Climate Program Office (CPO) has a staff of highly trained data visualizers and mapping specialists who contract with freelance visual science communicators regularly to assist in rendering climate science illustrations and designing reports for the public and decision-makers. CPO’s *Climate.gov News and Features*¹⁹ regularly posts climate updates paired with striking visualizations on their website as well as on social media. The Climate Explorer,²⁰ as part of the U.S. Climate Resilience Toolkit, provides an innovative interactive experience where users can “get a feel for future conditions” with visual data tailored to their own city or county. The NSF has contracted with visual science communicators such as Nicolle R. Fuller of Sayo Studio to produce some wonderfully detailed, narrative graphics for their program called “The Future of Work at the Human–Technology Frontier” (Fig. 4). At the USDA, Litwak rendered a “Farming and Eating Insects” poster to communicate how using insects as a protein source makes sense from an environmental perspective (Fig. 5).

An NGO doing something similar with a talented team of graphics editors is Climate Central.²¹ Their initiative titled “Picturing Our Future” presents interactive depictions of climate change in which viewers can manipulate photos to see the effects of various temperature increases on cities around the world. It’s extremely well done and not something that could have been accomplished with stock photography.

Still, many government and NGO presentations and papers are heavy on dry text, tables, and bar charts. What they are lacking are memorable, accessible visuals, particularly ones that can be picked up and shared easily over social and news media. This is a particularly interesting omission given that there seems to be a general understanding that drawing connections to people’s lives and livelihoods while providing them with positive examples of how we can (and are already) adapting is critical in getting individuals to change.²²

MAINSTREAM NEWS COVERAGE OF THE CLIMATE CRISIS

Climate scientists’ level of engagement with mainstream media is high compared with other disciplines.²³ So, it is even more important that they use every tool available to communicate with audiences with varying levels of interest and scientific literacy. Encouragingly, news outlets with larger budgets are creating print and online interactive narrative pieces that foster emotional engagement through impressive graphics and powerful storytelling, using tools such as ArcGIS StoryMaps. These are prime examples of what can be accomplished when visual elements are central to our science communication efforts.

The staff of *The Washington Post* won the “2020 Pulitzer Prize for Explanatory Reporting” for the series *2 °C: Beyond the Limit*.²⁴ Based on the authors’ analyses of global data sets and nearly 170 years of temperature records, the 10-article series mapped every place that has already warmed by 2°C (3.6°F)—the threshold that international climate negotiators say the earth collectively must never reach. Using photojournalism, interactive illustrations, and intuitive maps, they successfully drive home the point that extreme climate change is already a life-altering reality across 10% of the earth’s surface.

In 2019, the Norwegian Broadcasting Company (NRK) produced an interactive story package called *Chasing Climate Change*.²⁵ In a country of just five million people, it drew one million page views and won awards for its digital storytelling. It is optimized for mobile, rich with compelling photographs, and contains minimal text with scientific details tucked into pop-up features for those who are interested in engaging more deeply with the content. They followed it with a second piece titled *Velkommen til Oslo i år 2100*.²⁶ Set in the year 2100, it is a continuously scrolling illustrated work centered around an engaging cartoon woman who accompanies the reader throughout the story. As she uses her yellow umbrella creatively to float, fly, and stay dry through the narrative, the viewer is exposed to how livelihoods in Norway will change toward the end of the century due to climate alterations. The Society for News Design awarded the program “2020 Best In Show for Medium-Sized Newsrooms.” One judge commented, “bringing disparate datasets of the most daunting and complex topic of our time and presenting it in a relatable, personal, and non-overwhelming fashion is a huge achievement.”

The New York Times (NYT), too, has produced many successful experiments in visual science communication. In April 2021, they published a story titled *Bad Future, Better Future: A Guide for Kids, and Everyone Else, About Climate Change—and What We Can Do About It*, by Julia Rosen.²⁷ Through a richly illustrated, continuously scrolling experience, illustrator Yuliya Parshina-Kottas draws young readers into the story of how we got to this point in history and what we might do about it. Interactive features create the experience of being led through a narrative as though on a physical journey with the protagonist, wrist in hand, being pulled here and there as the story unfolds.

In July 2021, while much of the population of the U.S. sat inside due to poor air quality, Nadja Popovich (data and graphics reporter on the NYT’s Climate Desk) and Josh Katz (NYT graphic editor) utilized

data from NOAA’s Global System Laboratory to create a riveting online graphic visualizing the hotspots and dilutions of near-surface wildfire smoke.²⁸ On a darkened map of the U.S. and southern Canada, bright orange flames leap up in at least seven states and two provinces as winds spread the reddish-purple smoke across the continent. Though we were not able to access metrics on this particular image, we might assume Popovich and Katz’s animated map was at the very least served up to the 5.33 million digital subscribers of *The New York Times*.²⁹ This is a potent example of how much more visceral, concise, and memorable a well-executed stand-alone image can be than any of the articles that would have accompanied it.

FORMAL LEARNING ENVIRONMENTS

Anyone who has jokingly (or seriously) referred to themselves as a “student of life” understands intuitively that we never stop learning. Most of us begin learning, however, in formal environments, defined as structured learning facilitated by a teacher inside a traditional classroom. These are environments where we expect to encounter visuals, and indeed, a robust tradition of visual science communication already exists in K–12, technical, undergraduate, and graduate curricula.

**When the polar bear is
the most visible mascot
of climate change, it does
the rest of us a disservice
by making the issue seem
remote and distant.**

—HAYHOE, 2017 ³⁰

Classroom Textbooks

From illustrations to infographics, textbooks remain a lasting and effective communication medium in formal classroom environments, despite new models of publishing. And given that “inoculation”—reaching audiences early and first with accurate climate information—is a better way to combat misinformation than trying to “debunk” retroactively,³¹ the staying power of textbooks should be encouraging. However, in a recent survey of image allocation in college biology textbooks over the last 50 years, Jennifer Landin, Teaching Associate Professor in Biological Sciences at North Carolina State University, found that while the use of visuals about climate change has increased over time, the textbooks she surveyed are only featuring two climate change images on average, a number that seems comically low.³² Her research reveals that discussion of the

topic usually includes photographs of species facing extinction due to climate change (e.g., polar bears and butterflies) instead of visual interpretations of data or solution-oriented imagery (think renewable energy farms). As such, students could be forgiven for believing that climate change doesn't affect them—our communication to date has focused on distant species or far-away places that most will never see in real life, rather than direct ways in which climate change will impact their personal lives and communities. Landin also noted that coverage of climate change topics—including infographics describing changes in temperature, CO₂ levels, and species migration—has

science curricula.³³ She cites the benefits gained by looking intently at an object for a long period of time—you actually see more the longer you look—and notes that previous generations of scientists were required to know how to draw, precisely so they could “learn to observe” properly. Despite this, drawing has been largely eliminated from science curricula at this point, save for a few efforts like those being led by Landin.

One example of a lesson plan utilizing visual science communication comes from three educators at the Monterey Bay Aquarium Research Institute (MBARI), who hope to bring scientific data directly to educators and their classrooms. In 2016, they created a teaching module titled “What’s the Bigger Picture?” Available online through MBARI’s website, the lesson plan leads students through an exercise in creating graphs that visualize global climate change data, while using art to illuminate the context.³⁴ By imitating scientist-artist Jill Pelto’s innovative illustration style,³⁵ students transform their informative but staid line graphs into dynamic scenes that tell the story behind the data they depict (Fig. 6).

Books and journals published by the National Science Teaching Association (NSTA) are another rich source of information and lesson plan inspiration. Their publications address learning for all age groups and settings: *Science and Children* (elementary school), *Science Scope* (middle school), *The Science Teacher* (high school), *Journal of College Science Teaching* (postsecondary), and *Connected Science Learning* (informal). The July/August 2021 issue of *Science Scope* is of special relevance to this chapter, available on the NSTA website. The entire issue is dedicated to visual literacy and offers middle school teachers guidance on how to use graphs better in classrooms; how to integrate cross-cutting concepts from the Next Generation Science Standards; how to apply the “Drawing to Learn” strategy to encourage student understanding; and how to use “Big Data” to learn about the history of earth.

INFORMAL LEARNING ENVIRONMENTS

In contrast to formal learning, informal learning accounts for how most people learn about science outside of school.³⁶ Informal learning environments include museums, zoos, botanical gardens, libraries, community centers, and themed events like wildflower festivals and BioBlitz. Informal learning also occurs through the internet, television, radio, podcasts, and countless other everyday experiences, from childhood well into adulthood. As such, informal learning environments provide critical spaces for the public to learn about new ideas and to engage with these ideas in their own way.³⁷ Informal science



Figure 6: This student piece is an example of the fruits of the visual science communication exercises in the MBARI lesson plan (Chierici et al., 2016). Here, the student illustrates the effects of climate change that are being seen in coral reefs. The left side of the image shows cooler water temperatures and healthier, more colorful coral, whereas the right side of the image shows the death of the coral as the water temperatures get warmer. ©Caralyn Rexroad

not increased proportionately in response to the amount of data available.

How can we do better? Clearly, textbook publishers need to engage visual science communicators and their authors in increased climate science information. However, a major constraint in textbook publishing is the enormous amount of work that goes into each edition, forcing new editions to come out in a punctuated fashion, often with years passing between revisions. As textbooks are increasingly accessed online, this lack of responsiveness should abate. Until then, more responsive modes of teaching will need to pick up the slack in climate science communication.

Lesson Plans Utilizing Visual Science Communication

In addition to her work quantifying the number and type of illustrations included in textbooks, Landin touts the merits of reintroducing art education into

opportunities should be developed through collaborations between community members and educators, because such partnerships lead to *inclusive* science learning.³⁷ Visuals created for science communication can and should be present in all of these scenarios.

Children's Literature

A successful arena for science communication where scientists and visual science communicators already work well together is in children's picture books. Additionally, book publishers are turning their attention to comic books and graphic novels for emerging readers (ages 4–8) in response to the growing popularity of this same category with middle school students. Of great promise for visual science communicators is that publishers see an opportunity to tell many kinds of stories through this genre.³⁸

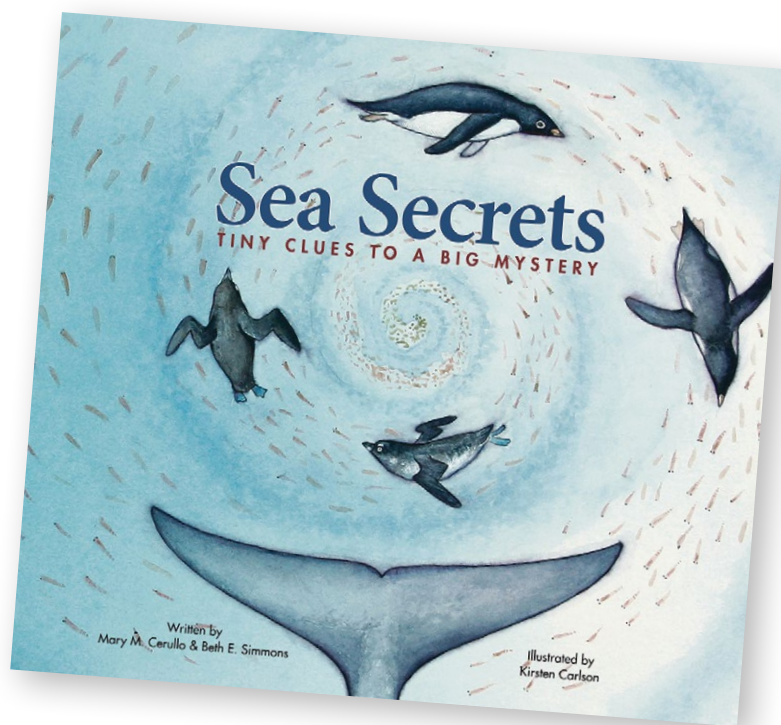
A prime example of researchers using picture books in their outreach programs comes from the NSF's Long Term Ecological Research (LTER) Network. Since 1980, 26 LTER sites have been documenting and analyzing environmental change around the world. As part of their outreach efforts, the program has created the Schoolyard Book Series for children, highlighting findings at 15 of the LTER sites.³⁹ With an emphasis on beautiful and accurate illustrations, scientifically reviewed content, and a narrative to encourage children to engage with the science featured at each site, this collection is an admirable example of how scientists can directly influence the richness of our education landscape.

Sea Secrets: Tiny Clues to a Big Mystery (Fig. 7), is written by Mary Cerullo and Beth Simmons and illustrated by visual science communicator Kirsten Carlson of Fathom It Studios. It uses a visual nonfiction narrative to invite young readers to explore ocean ecosystem shifts among three different species and their food source, krill, from California to Antarctica via the food web.

Children's Magazines

Magazines have a leg up on textbooks and picture books in that they are published more frequently and can theoretically be more current with the frontier of our scientific knowledge. They have the potential to be a critical tool in our dissemination of climate science progress.

The National Wildlife Federation's *Ranger Rick* magazine has been enchanting children for over 50 years with spectacular photography showcasing the wonder of the natural world alongside editorial-style illustrations that embellish their stories. But *MUSE*, a magazine for ages 9–14 published by Cricket Media, combines science and art in a way that more closely



resembles the ethos of visual science communicators. In February 2017, *MUSE* dedicated an entire issue to climate change.⁴⁰ The following year, they published an issue designed to “teach young readers how to gain an accurate understanding of a visually represented data set, as well as how to detect faulty infographics.” In this important issue, they broached many of the topics we discuss in this chapter with articles such as “Making Facts Plain to See: The Art of Data Visualization” and “Secrets of Visual Storytelling.” In these articles, they seek out and highlight the breadth of forms visual science communication can take, from Jill Peltó’s innovative adornment of graphs mentioned earlier³⁵ to Florence Nightingales’ famous rose diagram⁴¹ that gave visual weight to the different causes of mortality in the Crimean War, ultimately revealing that most soldiers didn’t die of combat, but of preventable diseases.

It should be noted that magazines aimed at educators are another frontier for visual science communicators. The popular environmental education magazine *Green Teacher* boasts an audience of 15,000 readers, 72% of whom are classroom teachers, librarians, and outdoor educators.⁴² *STEM ED Magazine* is another prime example; their objective is “to support and inspire as many educators as possible to enhance STEM learning.”⁴³ These magazines’ audiences and their reliance on photography would suggest they have an opportunity to collaborate more with professional visual science communicators to incorporate illustrations, infographics, and other visual learning activities that could then be passed on to students.

Figure 7: Cover of *Sea Secrets*, illustrated by Kirsten Carlson. ©2015 Kirsten Carlson, Mary M. Cerullo, and Beth E. Simmons

Outlets with Broad Appeal for All Ages

In the section on lesson plans, we broached the topic of how visual science communication exercises can aid learning in K–12 classrooms. But children are not the only group that can benefit from using drawing as a conduit to understanding and connecting more fully with the world around them.

Scientists' field and lab notebooks have long been places to record observations, reflections, sketches, diagrams, and data tables. Though they are not generally used for outward communication, they are a critical tool for observation and discovery. Nature journals, a close cousin of scientists' lab notebooks, provide a way for the general public to engage in this same exercise of careful, deliberate observation. Starting a nature journal does not require any previous art experience, nor does it use fancy or expensive supplies. It is a place to record what Dirnberger et al. (2005) call *raw knowledge*: newly acquired knowledge that will be processed and refined over time.⁴⁴ Journals help individuals become more familiar with their surroundings regardless of age or education and develop positive attitudes toward the natural world. Nature journaling can even be used successfully in urban environments to combat the "extinction of experience" which Lyn Baldwin, Associate Professor at Thompson Rivers University in British Columbia, refers to as the ever-increasing divide between people and nature.⁴⁵ Luckily, teachers and outdoor educators are increasingly familiar with nature journaling thanks to the growing popularity of global events such as John Muir Laws' Wild Wonder Nature

Journaling Conference⁴⁶ and International Nature Journaling Week.⁴⁷

In addition to the popular science magazines, we mentioned in the section on mainstream media and news, graphic novels are another great frontier for visual science communication. Thanks to publishers' growing appetite for books in this genre, we are beginning to see titles that expand beyond memoirs and fantasy into serious science communication works. Clifford V. Johnson's *The Dialogues: Conversations About the Nature of the Universe*, Maris Wicks' *Primates: The Fearless Science of Jane Goodall, Dian Fossey, and Biruté Galdikas*, and Michael Keller and Nicolle Rager Fuller's adaptation of Darwin's *On the Origin of Species* are successful examples of nonfiction graphic novels intended for an adult audience. Likewise, titles like the *Max Axiom, Super Scientist!* Series, and *The Manga Guide* series cater to younger readers with similarly serious aims of science education.

CONCLUSION

Researchers, publishers, news outlets, and communications teams need to recognize the importance of collaborating with professionally trained visual science communicators and create space in their budgets to support them. This small shift in priorities and funding allocations will dramatically improve the reach and rate of climate mitigation and adaptation efforts.

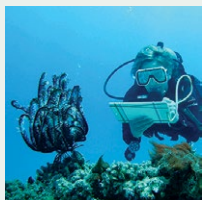


About the authors



Kalliopi Monoyios is driven by the conviction that science communicators operating in all spheres are a critical part of creating a scientifically literate public. After graduating from Princeton University with a degree in Geology, she built her career as a science illustrator for the prominent paleontologist Neil Shubin at the University of Chicago. Her illustrations have appeared inside and on the covers of *Nature* and *Science* and in four popular science books, including *Your Inner Fish* by Neil Shubin.¹⁶ In 2011, she co-founded *Symbiartic*, a blog covering the intersection of science and art for *Scientific American*. From 2020–2022, she served as President of the GNSI. She is currently devel-

oping new avenues of public engagement via her own art and curated exhibits that highlight the complexity of our relationship with plastic. Portfolio: www.kalliopimonoyios.com



Kirsten Carlson is an illustrator, designer, photographer, and writer. She interprets topics relating to the ocean and sea life through the lens of science and art. Her focus is to develop creative ways to connect different audiences to nature. She strives to produce works that speak to audiences with diverse educational backgrounds—scientists, educators, children, and the public. She is a graduate of the University of California, Santa Cruz Science Communication Program, an alumnus of the Artist-at-Sea Program with Schmidt Ocean Institute, and a grantee of the National Science Foundation Antarctic Artists and Writers Program. Her work can be seen at Fathom It Studios.

Portfolio: www.kirstencarlson.net



Taina Litwak has been a working illustrator since 1979 and a board-certified medical illustrator since 1994. She is currently the staff scientific illustrator with the USDA's Systematic Entomology Lab at the Smithsonian Institution's Museum of Natural History. Her illustration work includes a wide spectrum of scientific subject matter. Hundreds of her illustrations have appeared in magazines and scientific journals, trade and textbooks, advertising campaigns, nature centers, and medical-legal exhibits. She works primarily in digital media. Taina is currently a board member of ASCRL, the American Society for Collective Rights Licensing. She has also served as President and Treasurer of the GNSI, and as a board member of the Vesalius Trust. Portfolio: www.litwakillustration.com



Tania Marien is a podcast producer and educator. Her projects draw on her experiences working as an independent environmental education professional, first as the full-time editor, educator, and bookseller at ArtPlantae and now as a podcast producer, writer, researcher, and network builder. Tania connects independent environmental education professionals with new audiences to build partnerships and enhance environmental literacy in communities. She believes that independent professionals are overlooked and that their professionalism and contributions to lifelong learning need to be recognized. Documenting their work is important because it fills the knowledge gap about

how people learn about science and the environment outside of the classroom. Tania has an interdisciplinary studies master's degree in Biology and Student Learning and a professional certificate in Free-Choice Learning, which addresses the learning that occurs outside of the classroom throughout one's life. Tania is a contributor to *The Carbon Almanac* and The Carbon Almanac Podcast Network. Portfolio: www.talaterra.com



Fiona Martin appreciates visual communication because it is like a universal language—transcending barriers and facilitating understanding of complex ideas “at a glance.” Despite being born almost deaf, Fiona defied expectations, graduating at the top of her high school and college class. She holds a bachelor's degree in Marine Biology, *summa cum laude*, and a graduate certificate in Scientific Illustration from the University of California, Santa Cruz. Fiona is currently a visual journalist at *The Seattle Times*, creating explanatory graphics for climate, health, and other science stories. She also freelances from her studio Visualizing Science. Since 2005, she has produced

illustrations for government agencies such as NOAA's Climate Program Office and the National Park Service, as well as authors of scientific articles, reviews, and books, including *Growth and Decay of Coral Reefs* by Peter Vine, marine biologist and lecturer at the National University of Ireland, Galway.⁴⁸ Portfolio: www.visualizingscience.com

References for “Visuals as a Catalyst for Climate Science Communication,” Part 1

- 1 Real World Visuals. (2017). *About*. Retrieved December 10, 2021, from <https://www.realworldvisuals.com/about>
- 2 Real World Visuals. (2012, October 19). *New York City's greenhouse gas emissions as one-ton spheres of carbon dioxide gas* [Video]. YouTube. https://www.youtube.com/watch?v=DtqSlplGXOA&ab_channel=RealWorldVisuals
- 3 Fairman Studios. (2020, December 30). *Jennifer Fairman publishes COVID-19 visualization article in JNSI*. Retrieved April 29, 2022, from <https://www.fairmanstudios.com/project/covid-jnsi/>
- 4 Mesa Studios. (2021, January 15). *Microbiology*. Retrieved April 29, 2022, from <https://www.mesaschumacher.com/microbiology/>
- 5 Thorp, H. H. (2021). It's not as easy as it looks. *Science*, 374(6575), 1537. <https://doi.org/10.1126/science.abn7633>
- 6 Iyengar, S., & Massey, D. S. (2018). Scientific communication in a post-truth society. *Proceedings of the National Academy of Sciences*, 116(16), 7656–7661. <https://doi.org/10.1073/pnas.1805868115>
- 7 Zak, P. J. (2015, January). Why inspiring stories make us react: The neuroscience of narrative. In *Cerebrum: The Dana forum on brain science* (Vol. 2015). Dana Foundation.
- 8 Grady, C. L., McIntosh, A. R., Rajah, M. N., & Craik, F. I. M. (1998). Neural correlates of the episodic encoding of pictures and words. *Proceedings of the National Academy of Sciences*, 95(5), 2703–2708. <https://doi.org/10.1073/pnas.95.5.2703>
- 9 Ibrahim, A. M., Lillemoe, K. D., Klingsmith, M. E., & Dimick, J. B. (2017). Visual abstracts to disseminate research on social media. *Annals of Surgery*, 266(6), e46–e48. <https://doi.org/10.1097/sla.0000000000002277>
- 10 Zaelzer, C. (2020). The value in science-art partnerships for science education and science communication. *Eneuro*, 7(4). <https://doi.org/10.1523/eneuro.0238-20.2020>
- 11 Koo, K., Aro, T., & Pierorazio, P. M. (2019). Impact of social media visual abstracts on research engagement and dissemination in urology. *Journal of Urology*, 202(5), 875–877. <https://doi.org/10.1097/jju.000000000000391>
- 12 Houser, H. (2020). *Infowhelm: Environmental art and literature in an age of data*. Columbia University Press.
- 13 Hassenzahl, D. M., Stephens, J. C., Weisel, G., & Gift, N. (2013). Art and climate change references. In B. C. Black (Ed.), *Climate change: An encyclopedia of science and history* (pp. 1–5). ABC-CLIO.

- 14 Ramos, E., & Concepcion, B. P. (2020). Visual abstracts: Redesigning the landscape of research dissemination. *Seminars in Nephrology*, 40(3), 291–297. <https://doi.org/10.1016/j.semnephrol.2020.04.008>
- 15 Schwabish, J. (Host). (2021, November 16). Steve Franconeri and Jen Christiansen a VisComm Workshop (No. 205) [Audio podcast episode]. In *PolicyViz podcast*. DataViz Community. <https://policyviz.com/podcast/episode-205-steve-franconeri-and-jen-christiansen-a-vis-comm-workshop/>
- 16 King, H. M., Shubin, N. H., Coates, M. I., & Hale, M. E. (2011). Behavioral evidence for the evolution of walking and bounding before terrestriality in sarcopterygian fishes. *Proceedings of the National Academy of Sciences*, 108(52), 21146–21151. <https://doi.org/10.1073/pnas.1118669109>
- 17 Intergovernmental Panel on Climate Change. (2021). *AR6 climate change 2021: The physical science basis*. <https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/>.
- 18 National Intelligence Council. (2021). *Global trends 2040: A more contested world*. Retrieved December 12, 2021, from <https://www.dni.gov/index.php/gt2040-home>
- 19 Climate.gov. (2022, April 27). *News and features*. Retrieved April 29, 2022, from <https://www.climate.gov/>
- 20 The Climate Explorer. (n.d.). <https://crt-climate-explorer.nemac.org>
- 21 Climate Central. (n.d.). *Picturing our future*. <https://picturing.climatecentral.org>
- 22 Markowitz, E., Hodge, C., & Harp, G. (2014). In C. St. John, M. Speiser, S. Marx, L. Zaval, R. Perkowitz, & Center for Research on Environmental Decisions and ecoAmerica (Eds.), *Connecting on climate: A guide to effective climate change communication*. Center for Research on Environmental Decisions and ecoAmerica. <https://doi.org/10.7916/d8-pjjm-vb57>
- 23 Entradas, M., Marcelino, J., Bauer, M. W., & Lewenstein, B. (2019). Public communication by climate scientists: What, with whom and why? *Climatic Change*, 154(1–2), 69–85. <https://doi.org/10.1007/s10584-019-02414-9>
- 24 WashPostPR. (2020, August 6). The Washington Post's 2°C: Beyond the limit series recognized for outstanding explanatory reporting by the Society of Environmental Journalists. *The Washington Post*. Retrieved December 11, 2021, from <https://www.washingtonpost.com/pr/2020/08/06/washington-posts-2c-beyond-limit-series-recognized-outstanding-explanatory-reporting-by-society-environmental-journalists/>
- 25 Norwegian Broadcasting Company. (2020). Our climate journey through Norway. In: NRK. Retrieved December 11, 2021 from <https://www.nrk.no/chasing-climate-change-1.14859595>
- 26 Støstad, M. N. (2020). NRK avslører: Slik blir klimaet i Oslo. In: NRK. Retrieved February 28, 2024 from <https://www.nrk.no/klima/kommune/0301>
- 27 Rosen, J. (2021, April 18). A climate change guide for kids. *The New York Times*. Retrieved December 11, 2021, from <https://www.nytimes.com/interactive/2021/04/18/climate/climate-change-future-kids.html>
- 28 Popovich, N., & Katz, J. (2021, July 21). See how wildfire smoke spread across America. *The New York Times*. Retrieved December 11, 2021, from <https://www.nytimes.com/interactive/2021/07/21/climate/wildfire-smoke-map.html>
- 29 Statista. (2022, February 9). *New York Times Company: Digital news subscribers Q1 2014–Q4 2021*. Retrieved December 11, 2021, from <https://www.statista.com/statistics/315041/new-york-times-company-digital-subscribers/>
- 30 Hayhoe, K. (2017, October 9). Yeah, the weather has been weird. *Foreign Policy*. <https://foreignpolicy.com/2017/05/31/everyone-believes-in-global-warming-they-just-dont-realize-it/>
- 31 Lewandowsky, S. (2021). Climate change disinformation and how to combat it. *Annual Review of Public Health*, 42(1), 1–21. <https://doi.org/10.1146/annurev-publhealth-090419-102409>
- 32 Ansari, R. A., & Landin, J. M. (2022). Coverage of climate change in introductory biology textbooks, 1970–2019. *PLoS ONE* 17(12): e0278532. <https://doi.org/10.1371/journal.pone.0278532>
- 33 Landin, J. (2015, September 4). Rediscovering the forgotten benefits of drawing. Scientific American Blog Network. Retrieved September 12, 2021, from <https://blogs.scientificamerican.com/symbiatic/rediscovering-the-forgotten-benefits-of-drawing/>
- 34 Chierici, J., Couchon, K., & FitzGerald, N. (2016). *What's the Bigger Picture?* MBARI. Retrieved April 29, 2022, from <https://www.mbari.org/what-is-the-bigger-picture/>
- 35 Pelto, J. (n.d.). *Gallery*. Jill Pelto. Retrieved April 29, 2022, from <https://www.jillpelto.com/gallery>
- 36 Falk, J. H., & Dierking, L. D. (2019, November 6). The 95 percent solution. *American Scientist*. Retrieved December 11, 2021, from <https://www.americanscientist.org/article/the-95-percent-solution>
- 37 National Research Council. (2009). *Learning science in informal environments: People, places, and pursuits*. National Academies Press.
- 38 Alverson, B. (2021, February 26). *Comics formats go younger*. PublishersWeekly. Com. Retrieved September 9, 2021, from <https://www.publishersweekly.com/pw/by-topic/childrens/childrens-industry-news/article/85687-comics-formats-go-younger.html>
- 39 LTER Network. (2020, March 27). *Schoolyard book series*. LTER. Retrieved April 29, 2022, from <https://lternet.edu/schoolyard-book-series/>
- 40 Cricket Media. (2017, February). Climate reality. MUSE. Retrieved December 11, 2021, from https://aws.cricketmedia.com/pdfs/MUS/MUS1702.pdf?_ga=2.22292348.670518445.1743529627-1400982723.1743529580
- 41 Thompson, C. (2016, June 27). The surprising history of the infographic. *Smithsonian Magazine*. Retrieved January 20, 2022, from <https://www.smithsonianmag.com/history/surprising-history-infographic-180959563/>
- 42 Green Teacher. (2022, March 8). Retrieved December 11, 2021, from <https://greenteacher.com/>
- 43 STEM ED Magazine. (2021). Retrieved December 11, 2021, from <https://www.stemedmagazine.com/about/>
- 44 Dirnberger, J. M., McCullagh, S., & Howick, T. (2005). Writing & drawing in the Naturalist's journal. *The Science Teacher*, 72(1), 38.
- 45 Baldwin, L. K. (2017). Drawing care: The illustrated journal's "path to place". *Journal of Teaching in Travel & Tourism*, 18(1), 75–93. <https://doi.org/10.1080/15313220.2017.1404723>
- 46 Laws, J. M. (2017). *Wild wonder nature journaling conference*. John Muir Laws. <https://johnmuirlaws.com>
- 47 International Nature Journaling Week (n.d.). Homepage. <https://www.nature-journalingweek.com/>
- 48 Vine, P. (2023) *Growth and Decay of Coral Reefs: Fifty Years of Learning*. CRC Press. <https://doi.org/10.1201/9781003335795>



Left: Tread Carefully in the Redwoods. Santa Cruz black salamander (*Aneides niger*), redwood sorrel (*Oxalis oregana*), European earwig (*Forficula auricularia*), common pill woodlouse (*Armadillidium vulgare*) and coast redwood (*Sequoia sempervirens*). Gouache on hot press, cut paper dimensional collage. ©2024 Brynna Reilly, she/her. brynnailustrates.square.site

Below: Parental Parasitism. Brown-headed cowbird (*Molothrus ater*) and common yellowthroat (*Geothlypis trichas*). Graphite on Bristol®. ©2023 Tessa Wells, she/her. www.tessawells.com

Illustrating Nature CSUMB Science Illustration Graduate Program: Class of 2024

— by Emma Regnier and Karin von May

Last year, eighteen artists joined the 2024 Science Illustration Certificate Program cohort at California State University in Monterey Bay (CSUMB). The artworks on the following pages showcase the fruits of our time learning to create effective science illustrations. Each student applied their personal artistic sensibilities and passion for science communication throughout their experience in the program.



For us, Green Hall became our home on the edge of campus, set among the grove of Monterey cypress trees, beckoning chirps of the ground squirrels, and the footprints left by bobcats. Underneath a thick curtain of lace lichen, we sat two by two at each table and studied everything from anatomical accuracy to conceptual illustration. Through lectures and appointed assignments, we honed our technical knowledge of our trade as well as professional and

personal workflows. With open-ended assignments, we crafted illustrations that reflected our interests, and each critique was a chance to learn something new from our peers. From watercolor impressions of marine life living on a mussel's shell to the meticulously illustrated nerves of an alligator, we brought pieces of ourselves to share. We leaned on each other for moral support, inspiration, guidance, and a sense of place. We built a community that will

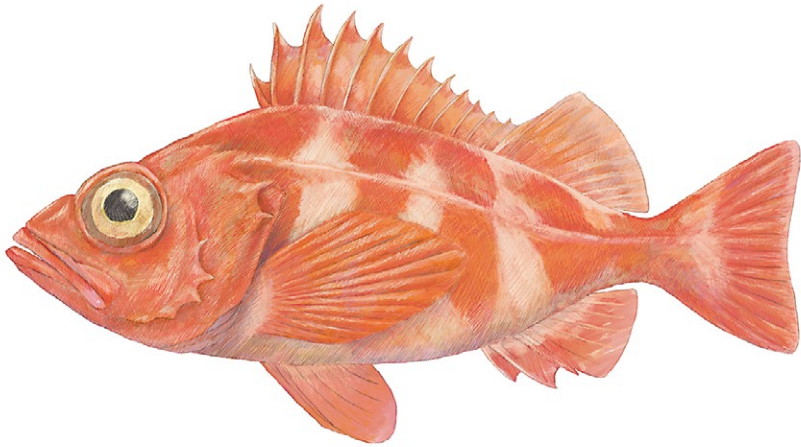
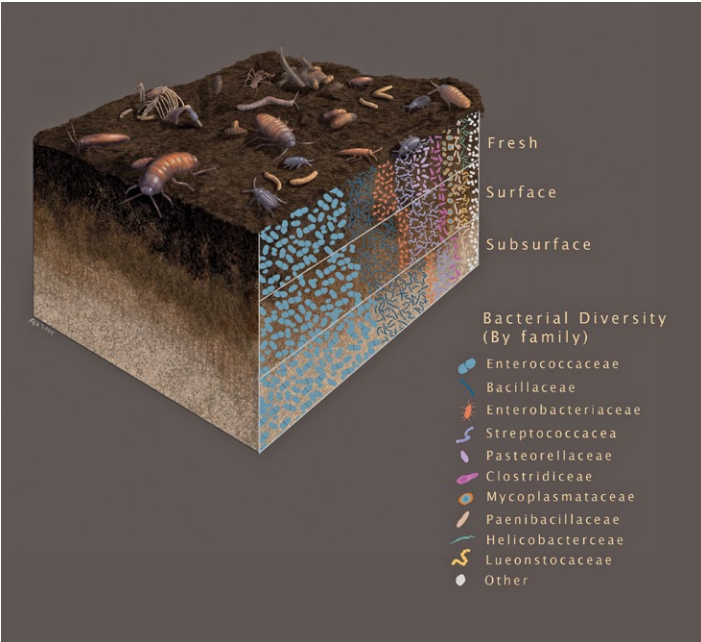
LEARN MORE about California State University Monterey Bay's Science Illustration Program at csumb.edu/scienceillustration/

stay with us long after we've moved away from Green Hall and the cypress trees. Some of us felt like birds of a feather for the first time, finding our flock. The feedback most often repeated about this program was a deep appreciation for the web of friendship and the encouragement found in the company of like-minded artists.

From bright-eyed beginnings, we completed three trying academic terms with ever-scaling levels of complexity and demand. We celebrated the culmination of months of preparation with our group show, *Illustrating Nature*, at the ever-charming Pacific Grove Museum of Natural History. Although many of us have since scattered to the winds as we forge our unique paths, we have the opportunity to look back and enjoy the memories of our metamorphoses. The images accompanying this article are but a small taste of the work created during our time in the program and cannot fully capture the enormity of the life lessons and knowledge of art-making gained in the last year. Remember the names of these aspiring illustrators because in a field as close as this one—intertwined by a shared love for science and art—we are bound to cross paths again in the near future.

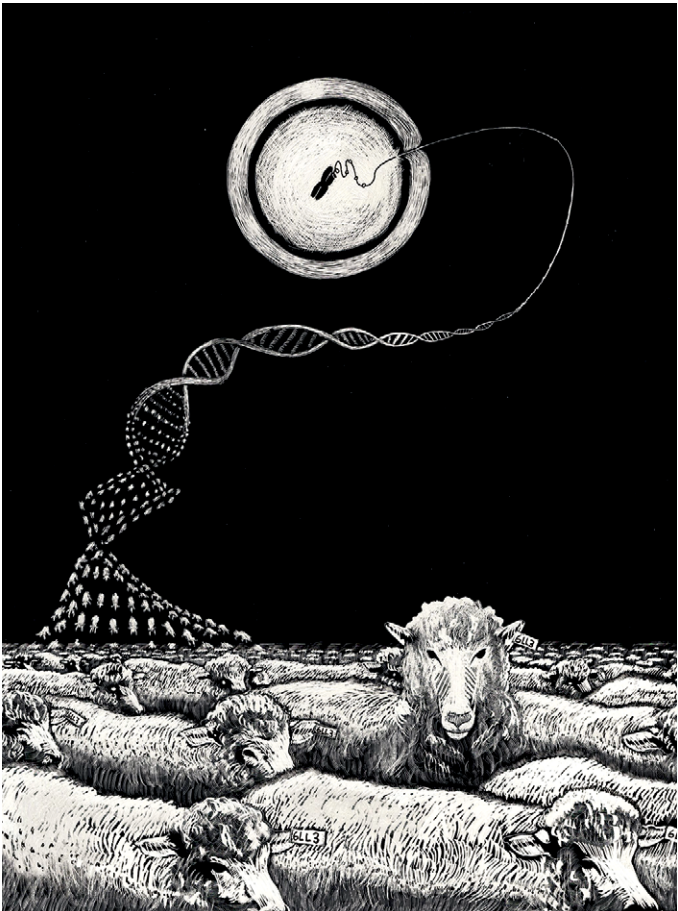


Below: The Relative Abundance of Bacterial Families Across Different Depths of Bat Guano. Cave millipede (*Speorthis tugaribus*), American cockroach (*Periplaneta americana*), and lesser mealworm (*Alphitobius diaperinus*). Adobe Photoshop and Illustrator. ©2024 Margaret Gleason, she/her. megleasonillustrat.wixsite.com/m-e-g-illustrations



Above: Splitnose rockfish (*Sebastes diploproa*). Clip Studio Paint®. ©2024 Evelyn Lam, she/her. www.evelynlamtsyu.wordpress.com

Below: Do Humans Dream of Identical Sheep? Finn Dorset sheep (*Ovis aries*). Scratchboard. ©2024 Parker Wong, he/him. www.pkwingillustration.com



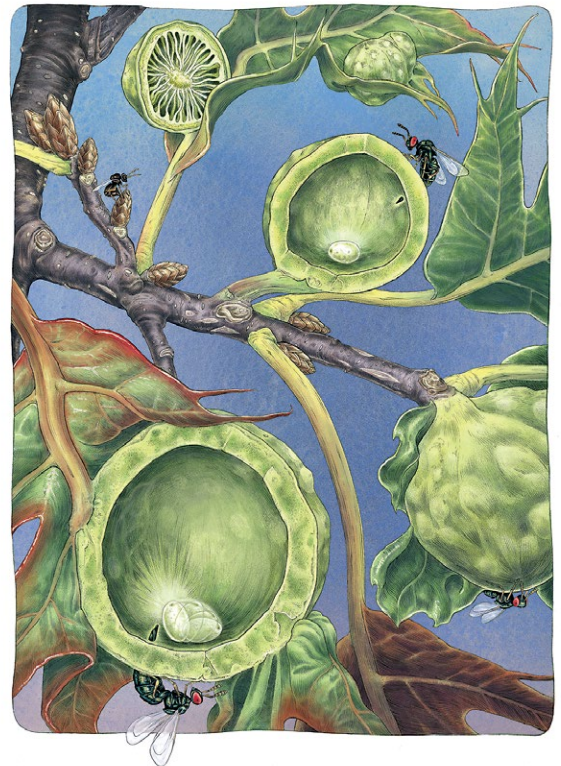


Above: Community Ecology of a Golden Eagle Eyrie. Nevada side-blotched lizard (*Uta stansburiana nevadensis*), violet-green swallow (*Tachycineta thalassina*), cliff swallow (*Petrochelidon pyrrhonota*), golden eagle (*Aquila chrysaetos*), western pipistrelle (*Parastrellus hesperus*), black-tailed jackrabbit (*Lepus californicus*), western deer mouse (*Peromyscus sonoriensis*), poultry bug (*Haematosiphon inodorus*), bushy-tailed woodrat (*Neotoma cinerea*), Mormon cricket (*Anabrus simplex*), American barn owl (*Tyto furcata*), European starling (*Sturnus vulgaris*), scarlet globemallow (*Sphaeralcea coccinea*), Great Basin gopher snake (*Pituophis catenifer deserticola*), cheatgrass (*Bromus tectorum*). Adobe Photoshop and Procreate®. ©2024 Emma Regnier, she/they. falcofous.wordpress.com/



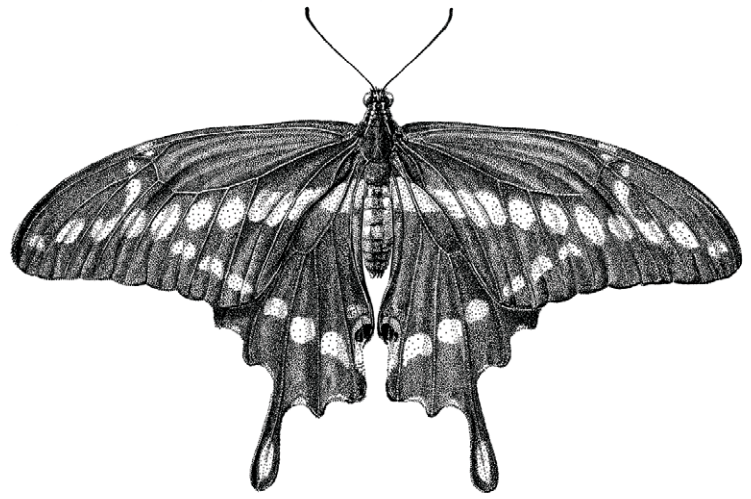
Above: A Coming-of-Age Story. Horsehair worm (*Paragordius* spp.). Ink on Bristol. ©2024 Haley Grunloh, she/her. www.haleygrunloh.com

Below: Roly-poly Gall Avoiding Parasitism. Roly-poly gall (*Dryocosmus quercuspalustris*) and chalcid wasp (*Ormyrus labotus*). Graphite on hot press and Adobe Photoshop. ©2024 Amanda Konishi, she/her. www.akonishi.com





Top left: Rosa the Sea Otter. Southern sea otter (*Enhydra lutris nereis*). Ink on Bristol. ©2024 Fengwei Zhang, he/they. www.fengweizhangart.com



Top right: The Striking Western Giant Swallowtail Butterfly Mid-flight. Western giant swallowtail (*Papilio rumiko*). Ink on Bristol. ©2024 Karin von May, she/her. www.karinvonmay.com



Middle: Living Rainbows. Peacock mantis shrimp (*Odontodactylus scyllarus*). Colored pencil on Dura-Lar®. ©2024 Ezra Edwards, they/them/theirs. ezedwardsart.com



Right: When Life Gives You Lemons. Monterey dorid (*Doris montereyensis*), noble dorid (*Peltodoris nobilis*), Heath's dorid (*Geitodoris heathi*). Adobe Photoshop and Illustrator. ©2024 Arin Vásquez, they/them. www.arinvasquez.com/squibbly/



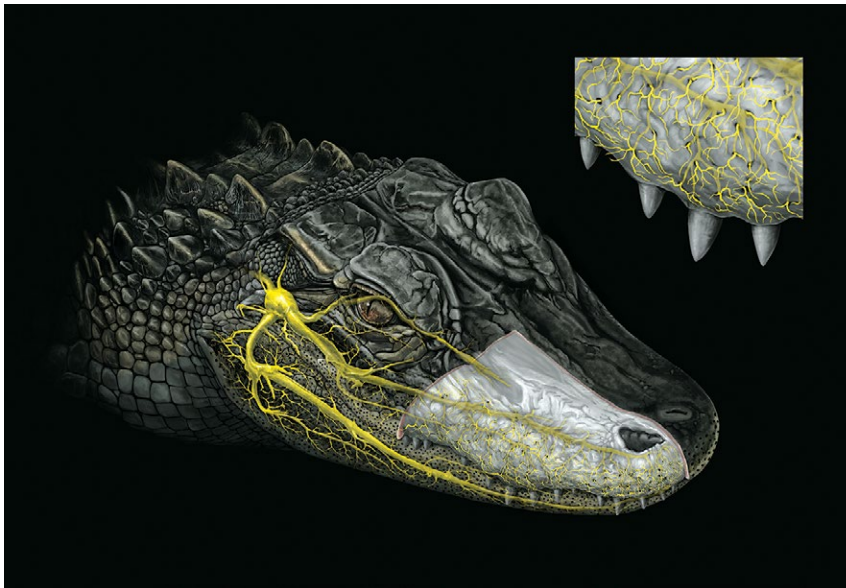
Left: Life in a Vernal Pool. Eastern ribbon snake (*Thamnophis saurita*), ringed boghaunter (*Williamsonia lintneri*), spotted turtle (*Clemmys guttata*), wood frog (*Lithobates sylvaticus*), eastern newt (*Notophthalmus viridescens*), spotted salamander (*Ambystoma maculatum*), eastern fairy shrimp (*Eubranchipus vernalis*). Mixed media on hot press. ©2024 Lauren Richelieu, she/her. www.laurenrichelieu.com



Above: Morning Catch. Belted kingfisher (*Megasceryle alcyon*). Watercolor on hot press watercolor paper. ©2024 Nyssa Prowell, she/her. www.nyssaprowell.com



Left: Strange Encounter. Hoatzin (*Ophisthocomus hoazin*). Acrylic and colored pencil on illustration board. ©2024 Josie Nelson, they/them. josienelsonillustration.neocities.org



Left: Trigeminal nerves of the American Alligator. American alligator (*Alligator mississippiensis*). Adobe Photoshop. ©2024 Ken Naganawa, he/him. [kenngnw14.wixsite.com/sci-art](https://www.kenngnw14.wixsite.com/sci-art)



Above: Make Yourself at Home. Southern flying squirrel (*Glaucomys volans*) and downy woodpecker (*Picoides pubescens*). Mixed media on wood panel. ©2024 Christina Weatherford she/her. www.instagram.com/cmw.illustrates/



Below: La Moule Bleue. California blue mussel (*Mytilus californianus*), gooseneck barnacles (*Pollicipes polymerus*), dulce (*Palmaria palmata*), pink volcanic barnacle (*Tetraclita rubescens*), acorn barnacles (*Semibalanus balanoides*), conspicuous chiton (*Stenoplax conspicua*), coralline algae (*Jania prolifera*). Watercolor on illustration board. ©2024 Monica Loncola, she/her. www.monicaloncola.com



Left: This year's conference logo features a right whale, chickadee, cranberries, and a ladybug, inhabitants of this year's conference location in Bridgewater, Massachusetts. Illustration by Hannah Sease. www.hannahsease.com

All images copyrighted by GNSI or individual artists, and shared with permission.

A Look Ahead at the GNSI Visual SciComm Conference

JULY 13–19, 2025

— by Stephen DiCerbo

It has been five years since the Guild of Natural Science Illustration has experienced the magic that has long been the core of its being—that of the in-person conference. From way back when, this was the only way Guild members could truly connect. It was where we have historically met face-to-face to network in a shared environment. Despite decades of advances in technology and social media, nothing can replace the value of in-person learning, nor the magic of casual conversations between sessions.

The conference team has been hard at work over the last couple years to bring this irreplaceable event back to all of us. The [conference website](http://www.gnsi.org/conference) is up and running, with the last details filling in daily.

Never attended an in-person GNSI conference? You're in for a treat! Experience a week-long immersion in visual science communication. Celebrate the history and functions of the Guild. More importantly, network with your peers and mentors, create lifelong friendships and connections,

and become a more intricately woven fiber in the cloth that is the Guild of Natural Science Illustrators. Early bird registration will be available April 5th through May 5th. Here's a look at some of the great events that lay in store for you!

THE LOCATION

The 2025 GNSI Visual SciComm Conference will be held in Bridgewater, Massachusetts, about 25 miles south of Boston and 35 miles east of Providence, Rhode Island. Like the hub of a wheel, Bridgewater

REGISTER
for the 2025 Visual
SciComm Conference:
www.gnsi.org/visual-sci-comm-conference



Above: Cranberry bog is convenient to the North Shore of Massachusetts Bay, Cape Cod, and Buzzards Bay near Long Island Sound.

The Bridgewater area is steeped in history and natural diversity. Nearby Hockomock Swamp is the largest freshwater swamp in the state. The Taunton River, with forty miles of free-flowing water, is the longest undammed coastal river in New England and supports the largest alewife (*Alosa pseudoharengus*) run in Massachusetts. Bridgewater is near some of the main cranberry cultivation areas in the U.S. The cranberry (genus *Vaccinium*) is native to the swamps and bogs of northeastern North America. The Wampanoag tribe, or “People of the First Light,” across southeastern Massachusetts have enjoyed the annual harvest of *sasumuneash*, or wild cranberries, for 12,000 years. Cultivation of the cranberry began in 1816 shortly after Captain Henry Hall, a Revolutionary War veteran in Dennis, Massachusetts, noticed that wild cranberries in his bogs grew better when sand blew over them.

Right: Self portrait, Barrett Klein.

Discover the influence of the area’s flora and fauna through the conference’s field trips, presentations, and discussions. There are also unlimited opportunities for self-organized outings and exploration. We look forward to seeing you there in July!

KEYNOTE SPEAKER
An Entomologist at the Intersection of Science and Art
 Dr. Barrett Klein

Barrett Klein revels in insect behavior, sleep biology, and the ways in which insects have affected humans throughout history. He studies sleep in societies of insects, creates entomo-art, and is fascinated by the

intersection of science and art. Barrett enjoys uncovering ways in which insects affect human culture, and feels most at home either in a forest surrounded by insects or in a natural history museum of oddities, where he once created exhibits.

Klein is an Entomologist, Science Illustrator, Professor of Biology, Author, TED Talk Presenter, and Lecturer. He studied entomology at Cornell University and the University of Arizona, received a PhD at the University of Texas at Austin, and fabricated natural history exhibits at Chase Studio and the American Museum of Natural History. In 2012, he joined the University of Wisconsin-La Crosse as a professor of biology.





Left: Fiona Martin and Taina Litwak.

PLENARY SPEAKERS

Visualizing Climate Science

Fiona Martin and Taina Litwak

During the pandemic, five GNSI members—Kalliopi Monoyios, Kirsten Carlson, Taina Litwak, Tania Marien, and Fiona Martin—coauthored an article published in an open-access book about visual climate science communication (Springer, 2024). Fiona and Taina will delve into the group's process behind the article, and an analysis of what is working and what is not in climate communication. SciComm professionals have a unique opportunity to transcend language and cultural barriers, learning differences, and knowledge or skill gaps. Well-designed visuals can deepen engagement, combat climate fatigue, improve decision-making, and encourage people to act in a way that makes sense to them and their community. Fiona and Taina will talk about visual science career paths with communication teams in academia, government, media, and formal and informal education. They'll share some practical strategies for creating more effective, engaging climate visuals, and how to represent abstract, often invisible processes. Then they'll open the floor for audience participation. Bring your thoughts and questions and be ready to join a robust discussion about climate visuals!

Fiona Martin is a graphic artist and science illustrator at The Seattle Times with 20 years of experience in visual science communication. Taina Litwak is a scientific and board-certified medical illustrator, recently retired from USDA. She has been a full-time illustrator for 40 years, primarily in the Washington, D.C. area.

PRESENTATIONS

We have 26 presentations in store for you in during the Core Conference on Monday, July 14th through Wednesday, July 16th. Everything from what it's like to work at *Natural Geographic* to "Curious Corvids." Learn about Gretchen Halpert's Scientific Illustration Distance Program and how to diversify your freelance illustration business. Listen to the "Artist Guide to the AI Landscape" and learn about "The Nature Notes" mural located along a restored riparian corridor in Arvada, Colorado.

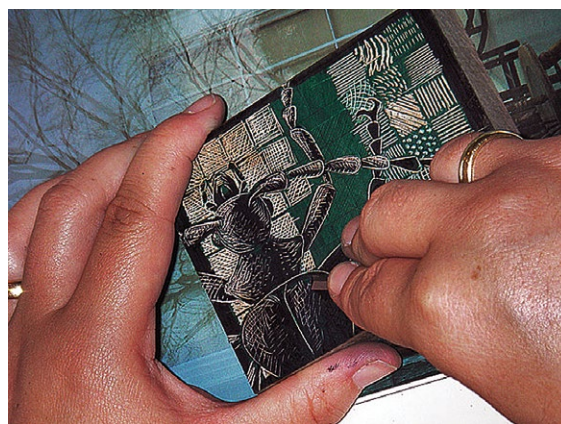
There will be three panel discussions—one about artists' residencies, one about Rhode Island School of Design's successful transition to teaching online during the COVID-19 pandemic, and another about artists inspiring conservation awareness, such as in the recent exhibition, "The Horseshoe Crab: Against All Odds."

WORKSHOPS

One of the more exciting features of our conference is back in spades! The second half of the week features hands-on workshops—both traditional and digital—in two-day, full-day, and half-day sessions brought to you by fellow Guild members and other professionals.

Learn techniques for rendering with acrylics and colored pencil, or take an introductory workshop in Procreate® for traditional artists.

You can choose to study traditional fish illustration and learn about the tools, procedures, and best practices for working with specimens in the studio. In another workshop, you can learn how to create knitted, crocheted, or other fiber-based art projects that represent scientific data in beautiful and approachable ways. Take a class on the process of sketching in scientific illustration, or a two-day course in Adobe After Effects with a step-by-step guide to animating a simple sequence.



Above: Wood engraving workshop. 2007 Bozeman, Montana conference.

Investigate all the workshop offerings and register for them on the GNSI's conference website.

Some of the unique full-day workshops include seaweed pressings (popular during the Victorian Age), and *Gyotaku*, or Japanese fish printing. Investigate all the workshop offerings and register for them on the GNSI's [conference website](https://www.gnsi.org/conference-website).

FIELD TRIPS

Feeling a bit more adventurous? The second half of the conference also offers a wide selection field trips... Cape Cod fishing, whale watching, kayaking tours, the New England Aquarium, the Harvard Museum of Science and Culture, a trip to Woods Hole Oceanographic Institute and much more. Get out of the classroom or studio and network with your

REGISTER

for the 2025 Visual SciComm Conference:
www.gnsi.org/visual-sci-comm-conference

Top left: Banquet dinner at the Arcadia, PA conference.

Top right: Open Studio Night (formerly called Techniques Showcase) at the 2007 Bozeman, Montana conference.

Bottom left: Welcome to the auction! 2014 Bozeman, Montana conference.

Bottom right: There was fierce bidding for this antique medical chart! 2009 Fort Kent, Maine conference.



fellow Guild members in the wild. More information is coming soon on the conference website.

EVENTS

Long-time favorite conference events are back, too. The **Awards Banquet** is a real highlight of the conference and provides a relaxed evening of fine dining and recognition of Guild volunteers.

Portfolio Sharing Night

is open to all attendees. Bring your portfolio, traditional or digital, and set it up on a table to present your work to other members. It's an excellent ice breaker.

The Opening Reception for the juried 2025

Annual Members Exhibition is another great social event and features the best work of Guild members.

Open Studio (previously known as the Techniques Showcase),

on Wednesday afternoon from 1:30–4:30 offers you a full afternoon of technique demonstrations by fellow Guild members. Many workshop teachers will be presenting here also, offering a snapshot of their workshops later in the week.

GNSI Auction: Call for Donations

Time to get the skeletons out of the closet! Look around your studio or basement or closet for whatever you can donate to this worthwhile event. Proceeds are split between the GNSI's general fund and the education fund, and the fun and frivolity are priceless. Bring your donations to the registration desk at the conference or ship them ahead of time...whether you are attending the conference or not! Send donations to:

*Chiquita Auctianna's Cave of Wonders
c/o Stormtree Studio
7 Kenakwar Lane
North Hudson, New York 12855*

Be sure to include a note saying who you are, what the auction item is, and its approximate value. On behalf of the GNSI, thank you in advance for your donation!



Left: Deb Haines. Portrait by Phil Snow, UTCVM medical photographer.

Member Spotlight

Deborah K. Haines (Deb)

GNSI PRESIDENT

— by Deborah K. Haines, BA, MFA, CMI, FAMI

Those of us who have a love of science and art—and refuse to give up one for the other—eventually find the Guild of Natural Science Illustrators (GNSI), or their compadres in Europe through AEIMS.¹ Those specializing in human medicine in North America gravitate to the AMI,² or in Europe to the IMI³ and MAA.⁴

I was fortunate to find the Guild early when seeking how I could combine both loves. I was the kid who loved biology, geology, dissection, and researching to figure out how things worked, whether in the physical or the mechanical world. I also loved to draw. My influences have been varied and include artisans, instructors, faculty, peers, and people who like to experiment with new media (whether traditional or computer). The Guild has been crucial in the role of education and sharing knowledge. The beauty of the

Guild is the variety of expertise and how others are using their skills to promote science.

A STORIED CAREER

Timing, location, and a bit of luck go into career endeavors, but to achieve anything one must be willing to explore, take some risks, and adjust. Before heading down the path we call scientific illustration, I was looking at three different paths: would I choose art administration, art therapy, or medical illustration

¹ AEIMS: Association Européenne des Illustrateurs Médicaux et Scientifiques, <https://www.aeims.eu/>

² AMI: Association of Medical Illustrators, <https://www.ami.org/>

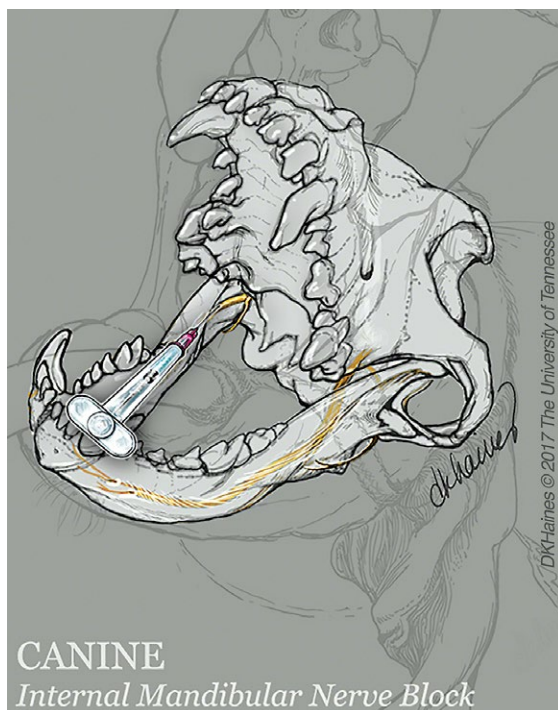
³ IMI: Institute of Medical Illustrators, <https://www.imi.org.uk/>

⁴ MAA: Medical Artists' Association, <https://maa.org.uk/>

Left: Internal Mandibular Anesthesia Block. Illustration shows innervation of location to administer anesthesia with open-mouth procedure.

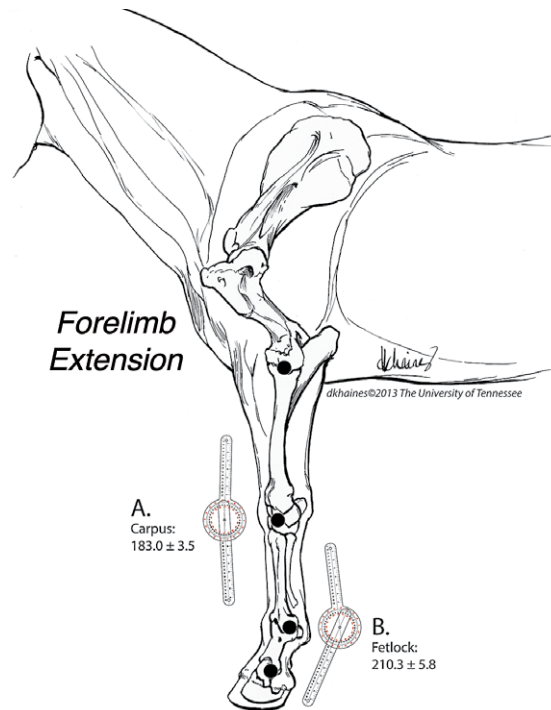
Designed to teach DVM students proper placement of anesthesia for an internal mandibular block. Created for Dr. Ralph Harvey by Deborah K. Haines ©2015 The University of Tennessee.

Right: Goniometric Studies of the Equine Limb. One of a series of line drawings created to show range of motion (extension and flexion) of both forelimb and hind limb for Equine Sports Medicine and Rehabilitation. All illustrations drawn to scale to ensure accuracy along with goniometric scale. Use of pen and ink, scanning and Adobe Illustrator for the goniometer. Series created by Deborah K. Haines for a research article written by Drs. Steve Adair (UTCVM) and Denis Little (at the time NC State). ©2013 The University of Tennessee



as my choice of vocation? After undergraduate school I worked in a regional hospital in an innovative Cultural Arts Program and with the Rehabilitation unit (PT/OT/Speech). Tasked with researching art therapy, I developed the ART CART. This program created an art gallery within the hospital focused on regional artists and brought hospital patients out of their rooms for weekly cultural presentations.

I soon realized my interests gravitated toward medical illustration as a goal. I moved to Indianapolis, met well known teacher Craig Gosling, and—with some perseverance—was hired as a Graphic Artist at the Indiana University School of Medicine. Gosling

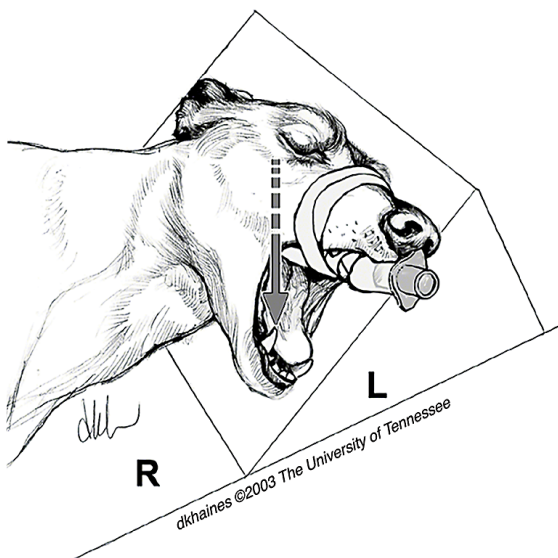


introduced me to GNSI. I had taken a scientific illustration course and realized it wasn't only about the ability to draw—there was so much to learn. I added courses to increase my knowledge. Around 1985, Gosling purchased the first Mac SE. He placed it near my workstation, so off I went exploring and taught myself the first version of Cricket Graph®, PageMaker®, and Adobe Illustrator®. It was a great experience as I worked with three medical illustrators, five graphic artists, four medical photographers, a medical sculptor, and a variety of doctors from all specializations (clinical and research).

It was through hard work and kindness of others that I was able to attend the MFA program in Medical and Biological Illustration at the University of Michigan under Professors Denis Lee, Gerald Hodge and Christopher Burke. Faculty and students were exploring first versions of computer graphics. From these explorations I gained an interest in animation. Post graduation I traveled to Tucson, Arizona, to work for a small innovative company doing accident reconstruction and medical-legal work. This was when all 3D computer generated objects were developed from scratch and straight from code. I researched and created storyboards and medical illustrations for various courtroom animations and demonstrative evidence boards. My next jump was back east to Knoxville to work at the College of Veterinary Medicine at the University of Tennessee in 1993.

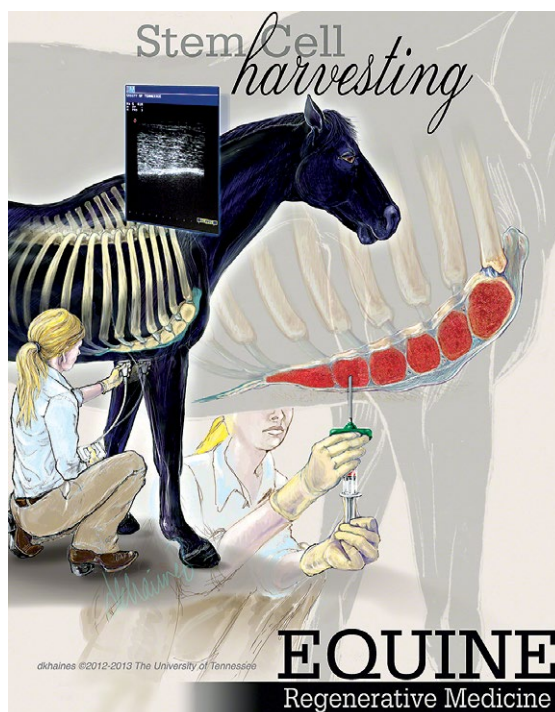
My goal has always been to be in environments that allow me to stretch, sometimes fall forward, but always to grow. By volunteering with professional

Right: Oblique Mandibular Anesthesia Block. Illustration by Deborah K. Haines ©2003 The University of Tennessee.





Left: Equine Foot Left Front (P1–3). Illustration shows proper settign of phalanges in relation to the hoof wall. Created by Deborah K. Haines for UTCVM Farrier Service. ©2015 The University of Tennessee.



Right: Equine Regenerative Medicine. First of three panels for an educational display on use of stem cells in veterinary medicine. Created by Deborah K. Haines for Drs. Dennis Geiser and Madhu Dhar, UTCVM Regenerative Medicine Research. ©2012–2013 The University of Tennessee.

organizations like GNSI, I have developed skills that I would have typically avoided. I encourage all our members to consider volunteering as much as they are able. I have been fortunate to have great mentors and friends, but the most valuable will always be the professional friendships. In most cases I have been the sole medical-scientific illustrator and bio-visualization specialist in my work. My peers have kept me current on trends and issues, provided constructive criticism, and advised me when an outside perspective was required.

Look to others to not just pat you on the back, but also for the reviews and comments that we need to grow. Even a seed, when watered, must push its way through dirt to see the sunlight and from the sunlight be energized to grow and flourish. As the cycle continues, the plant gives back by throwing out more seeds. Whether you are a new seed just planted, being watered, and starting to germinate, or sharing seeds of your expertise, please participate in any way you feel comfortable. Come develop amazing, talented friendships as a member of the Guild.

HUMBLE BEGINNINGS

You may ask, “Who is Deb Haines?” I grew up in the land of the Buckeyes⁵ to a mother who emphasized education and a father who said, “Have you solved the problem? What are your options?” At four years

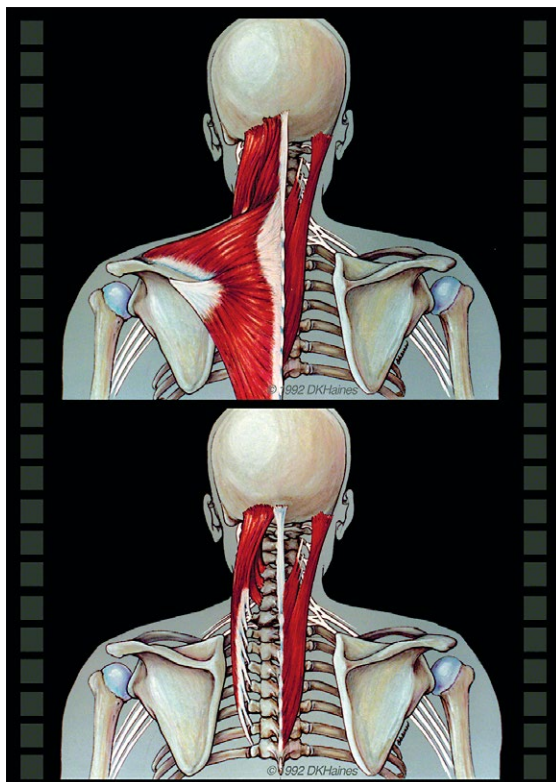
of age, I wanted to be a doctor and carried around my plastic medical bag, while my cousin wore his complete cowboy outfit. I cannot remember a time when my family didn’t have a dog or wasn’t taking care of birds. There were always pets in the extended family, both large animals and small. I continue to collect both domestic animals and wildlife. I still have *Encyclopedia of Animals*, the first book that my older brother and I pored over as children. He was a much better artist than me. (Healthy competition, criticism, and praise never hurt anyone.) The book had a dictionary at the back with black-and-white coquille illustrations of animals. Did I know what a coquille drawing was at the time? No, but I would look at them for hours. What was my first scientific illustration? I copied the nervous system of the grasshopper at age 11.

As I continued through middle and high school I had amazing math, science, and art teachers. But my education wasn’t just in the classroom; my brother and I experienced it. Our family camped across America (United States and Canada) which is how I experienced history and geography. On one camping trip out west, we stopped in Nebraska or Kansas⁶ and by the end of the two days I had “collected” over 50 pounds of sandstone rocks that I put in the trunk (boot) of the car. (Not something that would be acceptable today—do not take things out of state or

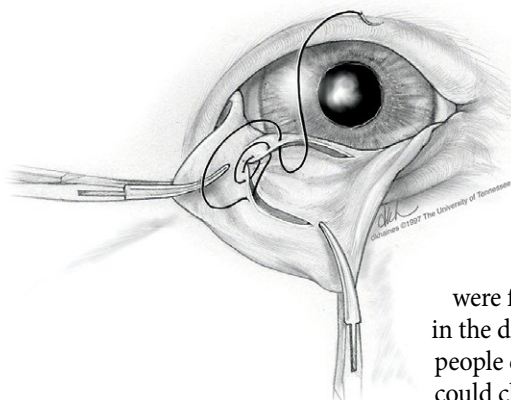
⁵ Ohio is known as the Buckeye State.

⁶ Locations for Niobrara Chalk formations: <https://www.nps.gov/niob/learn/nature/geologicformations.htm>
<https://www.nature.org/en-us/search/?q=Little%20Jerusalem%20Badlands%20State%20Park>
<https://outdoornebraska.gov/location/indian-cave/>
<https://www.onlyinyourstate.com/nebraska/sandstone-formations-toadstool-park-ne/>

Left: Whiplash. Researched, wrote script, storyboarded and developed the base art for animation incorporated into whiplash video. Illustrations show base art used in animation reveal of the muscles in the human neck and shoulders, posterior view. Canon Mi-Tientes® and Crescent® board, airbrush, cut paper, Berol-Prismacolor® pencils. ©1992 Deborah K. Haines.



Below: Third Eyelid Repair-Nictating Membrane. Final suture step to close repair. One of a series of ophthalmological surgical illustrations to accompany book chapters by Drs. Dan Ward and Diane Hendrix in Gelatt's *Veterinary Ophthalmology*, 2nd–4th editions and *Essentials of Veterinary Ophthalmology*, 1st edition. Carbon pencil and Faber-Castell® pencils on BFK Rives® paper. Illustration by Deborah K. Haines ©1997 The University of Tennessee.



national parks please.) Mom wanted to throw them out, but Dad said, “Leave her be; it’s not hurting anything.” The car hauled those rocks further west and then back home. Now that I think about it, the trunk wasn’t as low when we arrived back home. Mom may have dropped some out along the way. Another memorable camping trip was at age 13 in the Tetons.⁷ At dusk, while Mom and Dad were setting camp, my brother and I went exploring. We took a shortcut through a grove of woods back to our campsite and came upon a moose. We were about 10 feet apart and I was mesmerized. This was no Bullwinkle, and I was stoked!

More siblings came along, and at that time we were a one-income family. Summers were for planting and growing—digging in the dirt, planting seed. We were what people call urban farmers, and as kids we could choose our favorite vegetable or fruit to grow and tend. The earliest science question: What happens when you don’t water your plant? I think around that time I created my first botanical illustration, a painting of a dandelion in the style of a famous artist; I chose van Gogh.

⁷ The Teton Range is located in Grand Teton National Park in Wyoming.

LESSONS LEARNED

I was told from an early age that learning was my responsibility. I have been fortunate that I was encouraged to learn from whoever was the most talented, within reach. There was a small public library across the field from our house where I borrowed books once a week. Our summers were outside, but when it rained we were inside reading. If we asked for an answer from Mom, we knew her response would be, “Have you looked it up?”

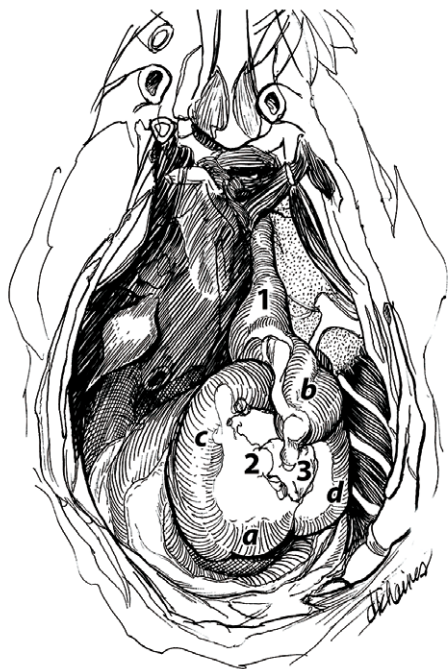
I had to learn, as an introvert, that my fear was often mistaken as ego by others. That appearance of ego (my fear) had to be placed on the back burner to excel. Striving for perfection could be a goal, but mistakes made along the way were part of the learning process; in other words, let curiosity pursue discovery. My uncle used to tell me, “One size doesn’t fit all, find your best fit.” Recognize that interest and focus may change over time, adapt. For instance, I have watched veterinary students as they began the curriculum tell me their career goals, but often with other experiences they redirect to a different path. They also ask my favorite question: WHY?

- Why does it work that way?
- Why should we do it one way over another?
- Why did they make that decision?
- Why was that question on the test? That diagram doesn’t make sense.

This can lead to their next question: WHAT?

- What would make it better?
- What makes things tick?
- What made them go in that direction instead of another?
- What is the purpose of the [fill in the blank]?

I believe we are born with curiosities embedded in our DNA. From watching my Dad build a tail-dragger biplane and letting me design the paint job, to helping measure a car so I could draw a figure to scale within the cross section showing the process of injury for an accident reconstruction case, or by dissecting a bird to understand how the amazing avian respiratory system works—the WHY, the WHAT, and the HOW questions are at the core of our work. To paraphrase Buzz Lightyear, we are natural explorers whether on the micro, macro, or universe level and beyond. As scientific/medical illustrators and biovisualization



Left: Avian Crop Anatomy. Part of a series of five illustrations for an article by Dr. Isabelle Langlois of North American Clinics about the anatomy and physiology of the avian gut. Pen and ink on Denril". Illustration by Deborah K. Haines ©2002 The University of Tennessee.



Right: Cartoon illustration "Who's Bad?" created for Dr. Michael P. Jones, Avian/Exotics DVM, to describe behaviors of different avian species. Final image created in Photoshop. Illustration by Deborah K. Haines ©2007 The University of Tennessee.

specialists we hope by asking those questions, it pushes us to create illustrations that illuminate. Sometimes the simplest illustration is the hardest to create because in its simplicity a flaw stands out. Decisions on what to include and what to take away are essential for the essence to be conveyed. But that is also part of the process of learning, improving, and sharing knowledge. Are we asking the right questions? Have we used the most current knowledge, and does our scientific illustration help someone understand the concept, the problem, or analyze a potential outcome/solution?

Is WHY still my favorite question? Yes, and I still collect a rock, shell, or bone from wherever I have visited or lived. I still love to figure out how things tick and to dissect anything and everything (animal, plant, or mineral). I never thought veterinary medical illustrations would be my vocation, but it's been 31 years and counting. Any critter, domestic or wild, will do. I love to travel to learn about different

cultures; we may live in different places, but we still have the same basic needs and desires. Technology and other factors often drive change, but don't forget to get outside, go exploring, do your research, take a sketchbook, and make some observations. My grandfather saw the first airplane fly and built a model; my other grandfather helped build Secret City (Oak Ridge, Tennessee). My parents saw the transformation of land speed records and space exploration. As a child I saw the first man walk on the moon, the space station built, and huge leaps in science, medicine, and technology. History tells us humans can create and solve problems. Let's illustrate solutions for our time. Hmm...I wonder, can I one day collect a moon rock?



DEB HAINES

Deb Haines has been a member of the Guild since 1990. Having drawn since a child, but never envisioning art as a career possibility, her dream was to be a family practice physician located somewhere in the mountains and have a barn full of animals. Working in the fields of human and veterinary medicine and the arts, she continues to explore how both traditional and innovative technologies and media can create didactic and interactive educational modalities. Whether collaborating on medical-legal illustrations, publications for peer-review journals, interactive CDs, uses of VR/AR, or mentoring individuals new to the profession, she likes to explore all possibilities. She works around amazing veterinarians, vet nurses, and support staff at the University of Tennessee College of Veterinary Medicine, and lives nestled in east Tennessee next to the Great Smoky Mountains surrounded by animals. Deb can be found on Facebook and LinkedIn. If not attached to technology, she loves to spend time hiking or outside in her yard digging in the dirt.

GUILD OF
NATURAL
SCIENCE
ILLUSTRATORS



P.O. Box 42410
Washington, DC
20015



Presentations • Workshops • Exhibits • Networking • Field Trips

Become a part of it all!

The Conference Team can still use volunteer help from the membership. Open positions are a small-time investment but have a big impact to the success of the conference. We also have room for a few more to showcase their techniques at the Open Studio Night (previously Techniques Showcase). To find out more or to volunteer, please email us at conference@gnsi.org.

Read the article inside about the Visual SciComm Conference, July 13th–19th, 2025. Visit the website for updates, event details, and registration.



REGISTER NOW!

gnsi.org/visual-sci-comm-conference