



Reaching Across Audiences: Connecting to and Communicating Botanical Concepts Through Art

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With increasing anthropogenic and climate-induced changes to our ecosystems (Groffman, 2014; Kidwell, 2015), it is more imperative than ever to foster a kinship between people and their environment and to enhance communication of ecological knowledge across audiences, from scientists to students and the public. Cultivating a personal connection to plants—from individual species to their foundational role in ecosystems—is especially critical, because doing so promotes a desire for conservation and a deeper understanding of our world's biodiversity. While many media platforms, such as nature documentaries, tend to focus on mammals (Howlett et al., 2023), plants account for 80% of total biomass on Earth (Bar-On et al., 2018) and serve as the building blocks of food webs. Yet nearly 40% of all plant species are classified as rare (Enquist et al., 2019).

Artwork presents one key avenue for promoting botanical literacy by creating an emotional, cross-scale connection to plants and fostering a bigger-picture context of plant responses to climate change. While detailed and highly accurate botanical illustrations date back centuries and were crucial in early efforts to record plant species prior to photography, recent trends in ecological education in STEAM (science, technology, engineering, art, and math) have moved toward a more holistic view of plants embedded within their abiotic and biotic environments. Parallel trends are occurring in the world of fine art, with pieces focusing on fostering a personal connection between humans and the botanical world. Here we examine how art promotes this connection between people and plants across biological scales.

Individual and Species-Level Scale

One of the most direct paths humans may take to connecting with plants is by bringing houseplants into their homes. Greening a home through the introduction of houseplants benefits mood and task attentivity, with even individual plants inspiring creativity (Shibata and Suzuki, 2002) and motivating artistic compositions that further botanical understanding. Houseplants skyrocketed in popularity during the COVID-19 pandemic (Phillips and Schultz, 2021), quickly becoming muses for creative projects such as leaf preservations, still life paintings, and artfully arranged terrariums. Plants also inspired artistic

competitions, such as one hosted by the Denver Botanic Gardens inviting artists to submit pieces representing how houseplants, gardens, and nature supported them through the COVID-19 pandemic (Denver Botanic Gardens, 2021) (Figure 1). During this time, an increase in emotional, sentimental attachment to plants also became evident. In addition to inspiring creativity, houseplants also benefit mental health as well as encourage mindfulness and self-care (Bringslimark et al., 2009). It is perhaps for this reason that many people who were quarantined away from both social and ecological interactions came to see their houseplants as sources of

personal joy, inspiration, and comfort during this time. Through art, this quiet connection may be succinctly and poignantly shared with any who may relate or sympathize with a similar connection to their personal plants.

Interactions with plants at an individual and personal scale also improved many owners' knowledge of botany. Plant ownership exposes non-academics to botanical concepts such as environmental requirements, anatomical terminology, key features for identification, and conservation concerns such as poaching of rare plants. From this increased knowledge arose artistic infographics and care sheets, spreading information on these concepts in a visually accessible medium (Briscoe, 2020).

Community and Ecosystem-Level Scale

The positive associations art can engender with indoor plants may be extended to connect people with larger natural systems, and botanical illustration continues to play a valuable role in the study of ecosystems. Artists may also look beyond the individual to capture the lives of plants within their larger landscape context.

Landscape fine artists often create artwork of plant communities at this moderate scale, moving beyond detailed renderings into the sphere of artistic interpretation of plants within their ecosystems. Using observation and knowledge of plant communities, artists convey the sense of a landscape using loose brushwork and rich color. The popular *plein air* movement (a French phrase meaning "in open air"), where artists are simultaneously inspired by and create directly in nature, began in the early 1800s, and was popularized during the Impressionism Movement (Callen, 2015) and continues to this day. This technique captures the effects of sunlight and shadow on a landscape, allowing artists to convey their emotional connection and impressions of

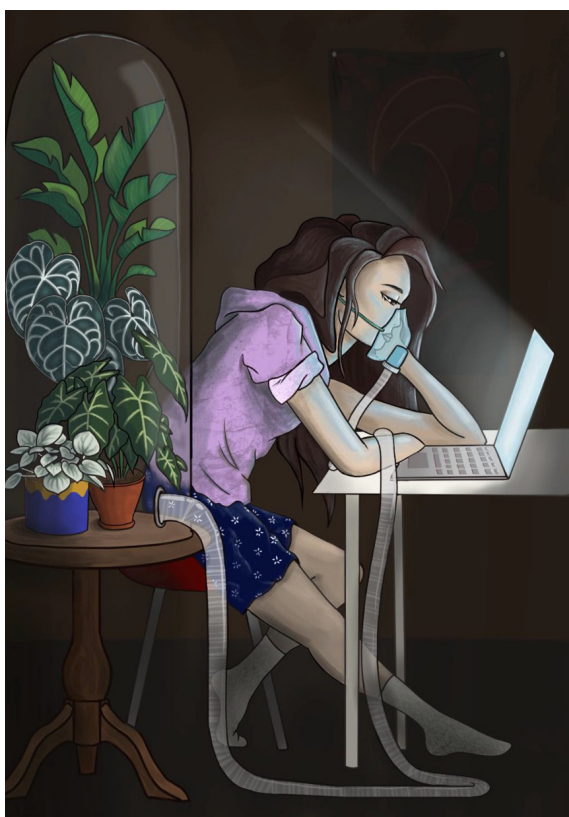


Figure 1. Life Support, 2021. Digital art by Janette Davidson. Image symbolically depicts a connection between people and plants, in how houseplants supported their caretakers through the quarantine period of the COVID-19 pandemic. This piece was created for the 2021 online art competition hosted by the Denver Botanic Gardens, "Plants Through Pandemic."



Figure 2. *Perfect Day Ahead, 2023. Oil on panel by Jennifer Shoemaker. Landscape of sage and lodgepole pine ecosystem, with a harmonious hiking trail snaking through. This piece was created as an example of integrating historical and modern plein air techniques.*

the landscape directly to viewers (The Art Story Foundation, 2023) (Figure 2). Through landscape art, viewers are invited to become absorbed in the feel of a plant community, developing a sense of place and appreciation at an ecosystem level (Malafronte, 2009). In this medium, we see ourselves not only observing the world of plants within their landscapes, but becoming immersed and ultimately belonging to that same world. As such, these landscape paintings can foster a personal desire to conserve ecological communities (Ostendorf, 2017; Renowden et al., 2022).

Global Scale

Art also has the potential to deepen general understanding of abstract botanical concepts, such as the risks of climate change to both humans and plants. In the modern milieu, where 40% of plant species face extinction due to threats such as climate change (Antonelli et al., 2020), promoting education of how plants are being affected on a global scale is imperative in eliciting support for conservation of these species. Through art, seemingly abstract data such as changes in temperature and climate patterns through time (Figure 3) can come alive and inspire action. However, communicating such topics, especially to school-aged audiences, presents a challenge because the concept may seem remote. An interactive art medium is therefore well suited to reach this audience and inspire students to take action.

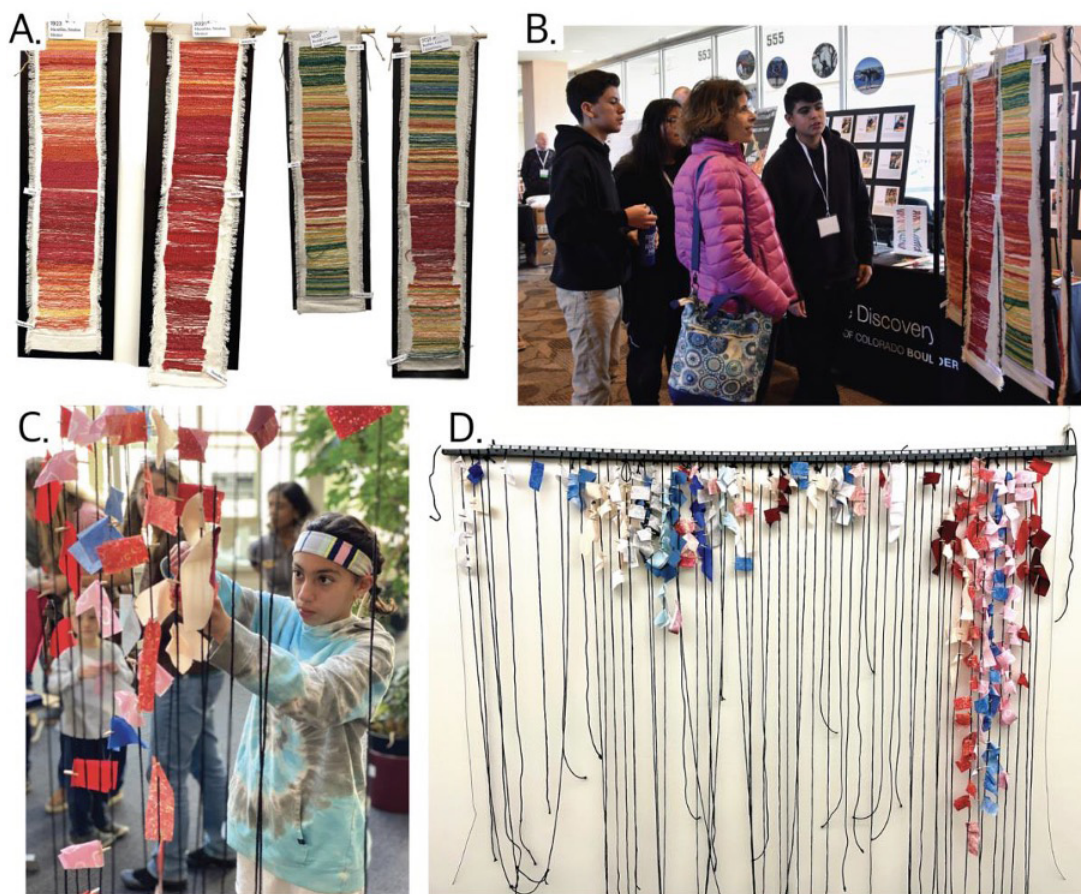


Figure 3. Collection of Tempesty (Barber and Gilson, 2023) educational and community artwork projects led by Dr. Alexandra Rose, depicting changes in temperatures over time in two North American cities: Mazatlán, Mexico and Boulder, CO, USA (A, B), and illustrating the global temperature during the birth year of project participants at local community events (C, D).

For young students, art can serve as a colorful and captivating communicator of science—particularly if the student is involved in the creative process. Studies show that incorporating art into learning environments may help students better retain information (Gullatt, 2008), and thus is a valuable tool in lessons about climate change. Through the creative process, students can directly connect to the data of their local environment (Figure 3A, B), promoting understanding for how this global problem can affect their smaller scale, local botanical communities. A similar artistic approach may be taken with communicating global science to a multi-generational audience. Involving citizens of varying ages can be powerful

for demonstrating trends through time at different points in their lives, for example by asking participants to attach color-coded cloth strips representing the average temperature in a given location during their birth year to a timeline (Figure 3C, D). Having the public contribute to interactive art exhibits at local community events, such as at libraries or farmers' markets, can convey a concise visual message on climate change impacts. Thereby, it can serve to initiate conversations about climate change or encourage families to contribute to conservation efforts themselves by fostering an emotional connection between plants, their ecosystems, and changes in climate.

Promoting Scientific Literacy through Emotional Engagement

Art's distinctive ability to establish emotional connections between viewers and the botanical world across scales, spanning from individual plants to botanical communities and a global context, make it an effective tool for communicating complex ecological concepts, eliciting pro-environmental attitudes and behaviors in society (Kals et al., 1999) and garner support for solutions-focused conservation research. In an era of global change, public understanding, socio-political interest, and economic support for plant conservation are more critical than ever (Balding and Williams, 2016). However, people often struggle to connect emotionally with plants, and many of the concepts behind cutting-edge conservation research can be difficult to convey to non-specialists due to their abstract, multifaceted nature. Education about conservation topics can greatly enhance community engagement with conservation work (Ardoin et al., 2020) and scientists are increasingly reaping the benefits of artistic approaches to communicating complex topics (Curtis et al., 2012). Furthermore, art-science integration can increase access to scientific knowledge that can be restricted behind paywalls.

For example, plant functional traits are grounded in theoretical concepts that can be used to generate general predictions for how species may respond to their environment and global change. However, few people are well-acquainted with traits, and the definition can be difficult to comprehend, especially for mathematically derived botanical traits such as specific leaf area (Violle et al., 2007). In cases such as this, artwork can facilitate

understanding and engagement with botanical concepts and conservation principles, such as how traits are used by research scientists to predict plant survival and adaptation in response to global change (Figure 4). The brevity and illustrative nature of the graphics served to share examples of conservation work and increase social capital for trait research by generating empathy for the pressures that plants face. This approach is merely one way art can distill abstract concepts into engaging visual stories that stimulate empathy and support for conservation. Other artists have leveraged similar approaches, such as comic strips (Kozik, 2021), to disseminate conservation science in a problem-solution framework. Artistic displays have immense potential to make science more approachable and to arouse curiosity and empathy for the botanical world.

Conclusions

Although art may appear, at first glance, to play a fading role in the academic world of botany, it is in fact one of our strongest tools for communicating science. Most people have an innate connection to nature, and whether it is strongest on a smaller personal scale with individual plants or a larger scale with landscapes, this connection can be utilized to increase awareness about plants and the challenges they face on a global scale. Botanical art can also serve as a gateway to awareness and aesthetic appreciation of the plant environment and its associated organisms, from microbes to pollinators. Art is a unique and valuable tool we must use to tap into humanity's connection with plants, to not only improve the efficiency and clarity with which we communicate science, but also stoke a passion for botany and conservation outside of the academic world.

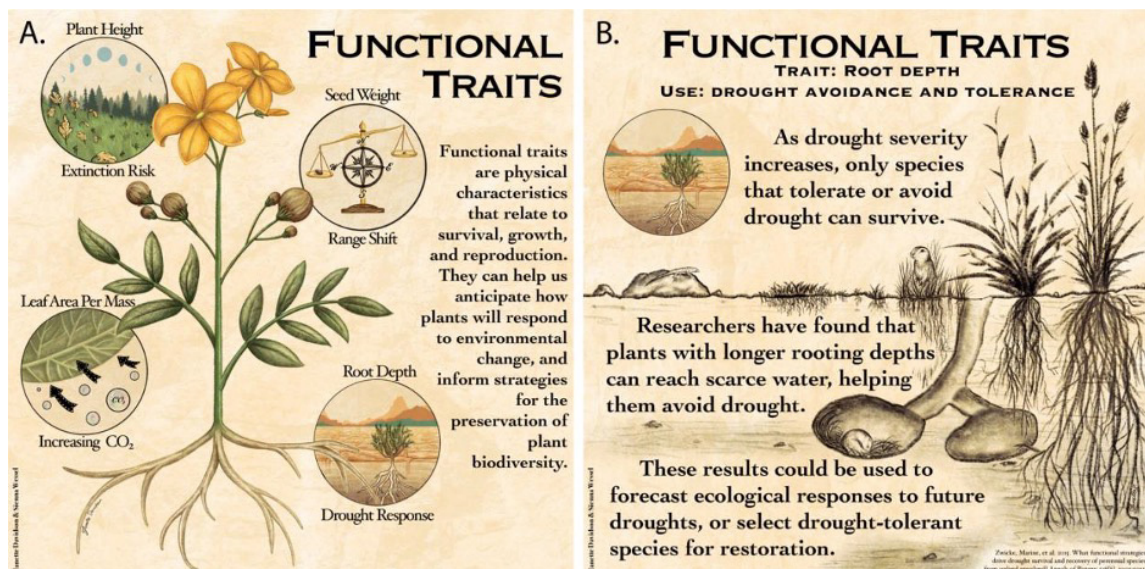


Figure 4. Functional Traits, 2022. Digital art by Janette Davidson, authored by Sienna Wessel and Janette Davidson. This shows two excerpts (A, B) from a five-part series of informational artistic graphics defining plant functional traits and describing how they can be used to inform conservation efforts. The series was shared to a broad audience via university-affiliated social media and a public gallery showing.

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