



**Biophilic Design on CSUMB's Campus:  
A 2021 Addendum to the 2017 Report**

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## Executive Summary

Many studies have documented the psychologically restorative benefits that come from nature contact. Biophilic Design is a concept to promote health-restoring spaces in the built environment. Because university students experience high levels of stress, biophilic design has been promoted as a means to promote student health and well-being through the integration of nature and natural processes into buildings and spaces on university campuses. In 2017, California State University Monterey Bay (CSUMB) committed to undertake the Living Community Challenge – a framework for master planning, design, and construction. The Living Community Challenge calls for integration of biophilic design into the campus landscape and buildings. In the Fall of 2017, students in the environmental studies research methods course explored the CSUMB campus for its existing and potential biophilic design features. This research continued within the research methods course for three additional semesters. To date, 93 students from four semesters and three years have examined the campus using photovoice. This report serves as an amendment to the initial 2017 report to include additional semesters of research and recommendations for biophilic design at CSUMB.

Favorable biophilic elements were fairly consistent across the four semesters of photovoice. For interior environments, key elements that students found supportive were areas with natural and diffuse light, areas with views of nature from building interiors, and areas that create a sense of enclosure or prospect and refuge for seating. Students liked seeing local culture and history represented. The most common interior representations were of natural history objects, such as shells, fossils, or museum specimens of local animals, including the sea otter, which students liked because it is the school's mascot and an ecologically important species in the ecology of the bay. Students also liked aspects of the campus that contributed to a sense of place, such as murals that reflected some of the natural and cultural history of the region, the "wishing tree" on which people can hang their written wishes, and the hammock area in a small grove of trees.

In the outdoor landscape, students preferred native plantings and commented frequently about invasive species, such as ice plant, as well as areas of campus that they feel are not well maintained or are ecologically degraded. They liked seeing sustainable innovations, such as bioswales for stormwater management and a native plant nursery. Students also liked outdoor seating areas that were surrounded by plants on three sides, with an open view, creating a sense of prospect and refuge as well as some shade. They particularly liked seating areas in which the materials felt harmonious with the landscape, such as through the use of log seating, or curved stone benches. Students also frequently liked walking areas with curved paths that created visual interest and flowering trees that attract birds.

Students emphasized the blurring between the indoors and out, with interior gardens or plantings, and windowed areas that lead out to natural courtyards. They emphasized the importance of bringing nature closer to and into buildings as a way to create restorative spaces. The university library was by far the most supportive place for students. This building also contains the most biophilic features in its design. It is highly effective at supporting views of sunsets, of open space and woodlands, diffuse and diverse light patterns, prospect and refuge, and natural shapes and forms.



Students identified a range of biophilic features, embedded within buildings as well as in the landscape. From left: Sensory garden, repeating patterns and shapes, fossil wall at library, and architectural curves.

## **Introduction**

The Living Community Challenge is a framework for master planning, design, and construction (Living Future, 2020). It is a tool for promoting symbiotic relationships between people and nature in the built environment. One aspect of the Living Community Challenge is the integration of biophilic design. As framed by Stephen Kellert and colleagues (2008; 2018), biophilic design moves beyond sustainability to create environments that are also restorative—for people and the living world. Kellert (2018) asserted that because people spend the majority of their time in built environments, we need to address systemic disconnections between people and nature *through* the built environment itself. Biophilic design is a way to achieve this through integration of nature and natural features into landscapes as well as buildings themselves. Jones (2013) conceptualized that biophilic universities can “restore an emotional affinity with the natural environment” (p. 148) including aesthetics, bio-cultural connections, and the development of physical and social university spaces. From a health promotion standpoint, the incorporation of biophilic design into university campuses is increasingly viewed as a means to promote student health and well-being, particularly because university students experience high levels of stress and mental health challenges (Chrisinger & Rich, 2020; Guwaldi et al., 2019; Krasny & Delia, 2015).

Many studies have documented the restorative benefits that come from contact with nature including reduced stress; reduced depression and anxiety; greater happiness and sense of well-being; reduced ADHD symptoms; increased prosocial behavior and social connectedness; and short- and long-term physical health outcomes (Frumkin et al., 2017; Hartig et al., 2014). A review of psychological benefits of biophilic design found that while many restorative environments focus on visual experiences, other sensory elements, such as plants with mild fragrance, bird song, and nature sounds, are also restorative (Gillis & Gatersleben, 2015). In their review of the research literature, Frumkin et al. (2017) suggest that although a broad range of positive benefits have been identified from human contact with nature, a range of research questions remain. These include the need to understand which forms of nature contact are most beneficial and how cultural and contextual factors might affect nature preferences and experiences.

In this context, the photovoice method provides an opportunity for students to explore these questions from the perspective of their lived experiences on a college campus. This approach has the potential benefits of addressing larger scale research questions about specific aspects of nature (and biophilic design more generally) that students experience as positive, as well as to guide planning and design of a specific college campus. A recent review of biophilic design and university campuses found that students are often participants in research about biophilic design and restorative campus environments (Peters & D’Penna, 2020); however, the majority of these studies engage students in research through the use of surveys, simulations, and virtual or digital depictions of the environment rather than the physical environment itself. Peters & D’Penna (2020) recommended more research about biophilic spaces be conducted in actual physical environments because “biophilic design concerns far more than visual qualities and is multi-sensory and context-specific” (p. 7). Through the Research Methods in Environmental Studies (ENSTU 350) course, students do just that: they explore biophilic design on their college campus through their multisensory lived experiences.

## **Photovoice Method**

Photovoice has been employed on university campus settings, with students exploring natural spaces as sites of mental restoration (Reese et al., 2020; Seitz et al., 2014). The application of photovoice presented here explores the entirety of the campus environment as a means to determine the potential for restoration in buildings, where students spend the majority of their time, as well as in outdoor spaces.

In class, the instructor (this report's author, Victoria Derr) reviewed the basic biophilic design elements as developed by Kellert (2008) (Table 1, next page) through a film, readings and discussion. Students were instructed that they would employ photovoice as a means to explore the campus and evaluate its strengths and weaknesses in terms of these biophilic design elements.

Students were given red and green frames that they used to highlight aspects of campus that they did not think were supportive (red frames) or that were supportive (green frames) for biophilic design. Students were asked to specifically photograph attributes of the campus that corresponded with biophilic design elements (Table 1). However, while photographic choices were structured by elements, students had flexibility in the number of photographs they took per category and the number of campus attributes that they liked (green frames) or felt could be improved (red frames). Students recorded the photograph image number and why they felt that each photograph reflected the biophilic design element for which it was listed. Students then annotated and uploaded their photographs into pre-labeled folders on a shared drive for each of the six biophilic design elements. In the following class session, students reviewed the photographs from each of the six folders, making notes of common themes. After students had reviewed the photographs, the class collectively discussed the photographs and identified overall themes and trends. Students then individually wrote up lab reports in which they reviewed the photographs in more depth and provided recommendations for campus planning.

This process has been implemented during four iterations of the course, over three years. Between 15 and 28 students enrolled in the course each semester for a total of 93 students. In the first year, the campus was just beginning to consider how biophilic design might be integrated into the campus. In addition to photovoice, students interviewed campus staff, faculty, and students, and facilitated a focus group for desired biophilic spaces on campus. Results from this first year were shared at a campus-wide State of Sustainability event and through a written report published in 2017 (Derr et al., 2017).

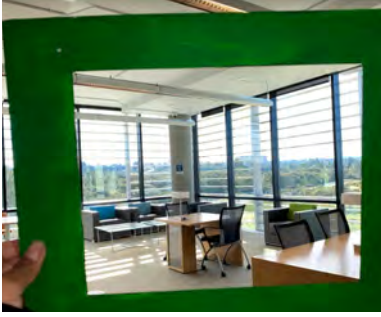
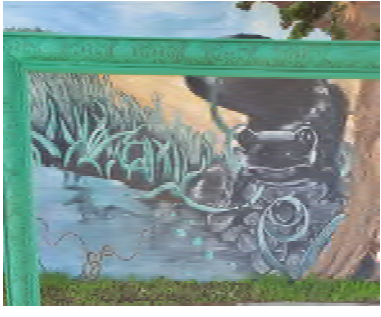

### **Photovoice Outcomes**

Favorable biophilic elements were fairly consistent across the four semesters of photovoice (Table 2, next page). For interior environments, key elements that students found supportive were areas with natural and diffuse light (Figure 1), areas with views of nature from building interiors (Figure 2), and areas that create a sense of enclosure or prospect and refuge for seating. Students liked seeing local culture and history represented. The most common interior representations were of natural history objects, such as shells, fossils, or museum specimens of local animals, including the sea otter, which students liked because it is the school's mascot and an ecologically important species in the ecology of the bay. Students consistently liked murals and mosaic art that reflected cultural history (Figure 3).

In the outdoor landscape, students preferred native plantings and commented frequently about invasive species, such as ice plant, as well as areas of campus that they feel are not well maintained or are ecologically degraded. They liked seeing sustainable innovations, such as bioswales for stormwater management and a native plant nursery (Figure 4). In terms of comfort and restoration, students also liked outdoor seating areas that were surrounded by plants on three sides, with an open view, creating a sense of prospect and refuge as well as some shade (Table 2). They particularly liked seating areas in which the materials felt harmonious with the landscape, such as through the use of log seating, or curved stone benches. Students also frequently liked walking areas with curved paths that created visual interest (Figure 5). They also liked areas that were in some way unique on the campus. These included murals that reflected some of the natural and cultural history of the region (Figure 3), a "wishing tree" in a campus courtyard on which people can write and hang their wishes (Figure 5), and a hammock area in a small grove of trees.

**Table 1. Biophilic Design Elements and Attributes (Kellert, 2008)**

Environmental Features	Natural Shapes and Forms	Natural Patterns and Processes
<ul style="list-style-type: none"> <li>Color</li> <li>Water</li> <li>Air</li> <li>Sunlight</li> <li>Plants</li> <li>Animals</li> <li>Natural materials</li> <li>Views and vistas</li> <li>Façade greening</li> <li>Geology and landscape</li> <li>Habitats and ecosystems</li> <li>Fire</li> </ul>	<ul style="list-style-type: none"> <li>Botanical motifs</li> <li>Tree and columnar supports</li> <li>Animal motifs</li> <li>Shells and spirals</li> <li>Arches, vaults, domes</li> <li>Shapes resisting straight lines and right angles</li> <li>Simulation of natural features</li> <li>Biomorphy</li> <li>Geomorphology</li> <li>Biomimicry</li> </ul>	<ul style="list-style-type: none"> <li>Sensory variability</li> <li>Information richness</li> <li>Age, change, and the patina of time</li> <li>Growth and efflorescence</li> <li>Central focal point</li> <li>Patterned wholes</li> <li>Bounded spaces</li> <li>Transitional spaces</li> <li>Linked series and chains</li> <li>Integration of parts to whole</li> <li>Complementary contrasts</li> <li>Dynamic balance and tension</li> <li>Fractals</li> <li>Hierarchically organized ratios and scales</li> </ul>
		

Light and Space	Place-based Relationships	Evolved Human-Nature Relationships
<ul style="list-style-type: none"> <li>Natural light</li> <li>Filtered and diffuse light</li> <li>Light and shadow</li> <li>Reflected light</li> <li>Light pools</li> <li>Warm light</li> <li>Light as shape and form</li> <li>Spaciousness</li> <li>Spatial variability</li> <li>Space as shape and form</li> <li>Spatial harmony</li> <li>Inside-outside spaces</li> </ul>	<ul style="list-style-type: none"> <li>Geographic connection to place</li> <li>Historic connection to place</li> <li>Ecological connection to place</li> <li>Cultural connection to place</li> <li>Indigenous materials</li> <li>Landscape orientation</li> <li>Landscape features that define building form</li> <li>Landscape ecology</li> <li>Integration of culture and ecology</li> <li>Spirit of place</li> <li>Avoiding placelessness</li> </ul>	<ul style="list-style-type: none"> <li>Prospect and refuge</li> <li>Order and complexity</li> <li>Curiosity and enticement</li> <li>Change and metamorphosis</li> <li>Security and protection</li> <li>Mastery and control</li> <li>Affection and attachment</li> <li>Attraction and beauty</li> <li>Exploration and discovery</li> <li>Information and cognition</li> <li>Fear and awe</li> <li>Reverence and spirituality</li> </ul>
		

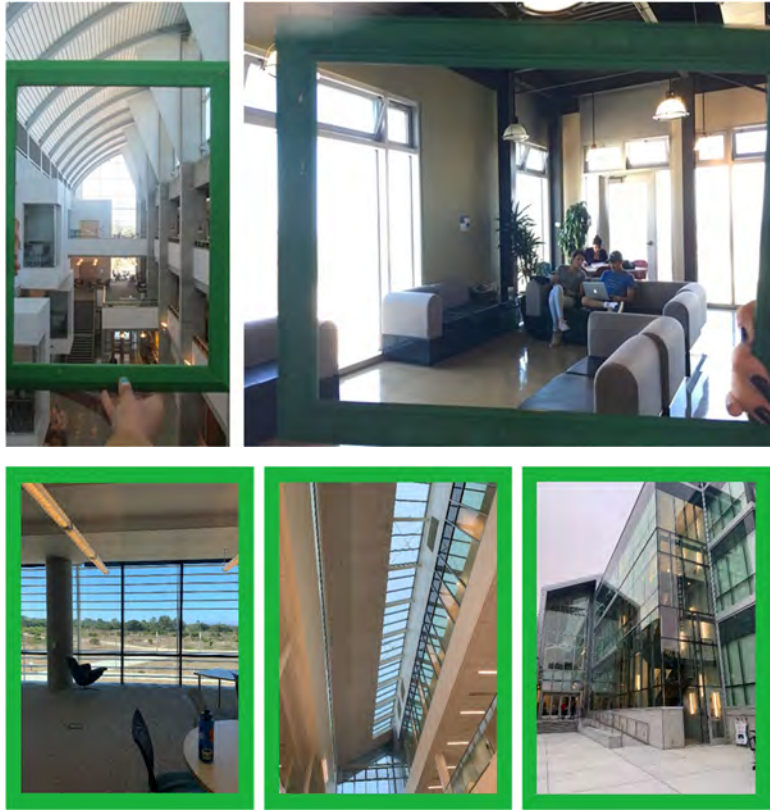


Figure 1. Students consistently identified the infusion of light into classroom and study areas as a strongly preferred element of biophilic design. Top left, “the library offers lots of space and natural lighting.” Top right, “Chapman: studying with plants and lots of light.” Bottom left, “Warm rays penetrate through this library window all the time.” Bottom center, “Natural ceiling light in BIT building.” Bottom right, “BIT building used lots of windows to bring light to all parts of the building.”



Figure 2. Students liked transition spaces that blur the indoors and out and felt the campus could bring more of these into the built environment. The background of the photo at left also shows the ocean views possible from some buildings, which students highly prized. Top left, “A peaceful, natural view.” Top right, “connects the buildings with the outdoors.” Bottom left, “Third floor library ocean view.” Bottom center, “Partial wood wall and many windows beside a tree.” Bottom right, “CHHS Building provides natural light, open space, trees and greenery from the inside.”

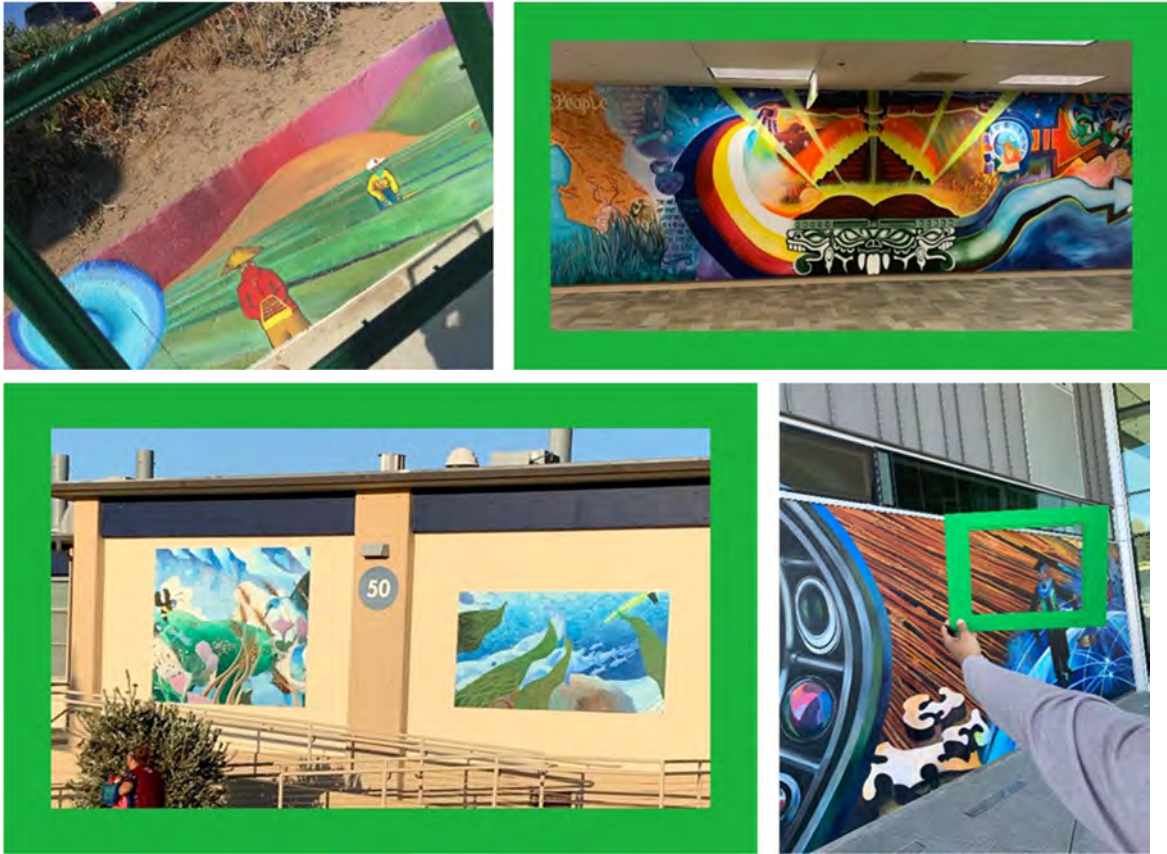


Figure 3. Students thought murals were effective ways to convey history, culture, and place-based relationships. Top left, “Mural shows historic, cultural connections to place and has nice patterns.” Top right, “Student Center mural shows California history.” Bottom left, “Shows importance of our ocean ecosystem.” Bottom right, “Words and phrases in various languages have cultural connections.”



Figure 4. Students often identified ways that the campus was effectively making sustainability visible, such as through bioswales, native plant nurseries, or refillable water stations. At left, “Bioswale provides natural drainage and habitat.” At right, “Garden nursery: growing native plants creates place-based relationships.”



Figure 5. Even small spaces of nature were valued by students, such as this walkway between two campus buildings (left) and the “wishing tree.” At left, “Walkway is open, peaceful.” At right, “The wishing tree helps students connect to nature;” “the wishing tree is a place of spirituality and positive affirmations.”

Some students showed a proclivity for working and being indoors, and for these students, indoor plants, views from windows, and interior biophilic design features were important. Students also had differing opinions about some plant types in the landscape. Notably, some of the Chicana students really liked plantings of agave and other species that “remind me of Mexico,” whereas some other students did not like these plantings because they were not native to the region.

In terms of mental restoration, the majority of students emphasized the importance of light and views from interiors because that is where they spend the majority of their time, both studying and working. They also expressed wanting to see more blurring between the indoors and out (Figure 2), with interior gardens or plantings, and windowed areas that lead out to natural courtyards. They emphasized the importance of bringing nature closer to and into buildings as a way to create restorative spaces (Figure 2). The university library was by far the most supportive place of refuge for students (Figure 1 and 2). This is one of the more recent buildings on campus, and contains many biophilic features in its design. It is highly effective at supporting views of sunsets and the ocean, views of open space and woodlands, diffuse and diverse light patterns, prospect and refuge, repeating patterns, and natural shapes and forms. Campus libraries are a place where students spend large amounts of time, often under stress, and so the biophilic features are especially noticed and valued by students in this context.

## Discussion

Overall, students enjoyed using photovoice as a way to think about their campus and as a way to express how they feel about a place that is central to their quality of life. The photovoice method in itself seems to be therapeutic, as students reflect on spaces that are supportive or need more work; expressing and sharing their views with peers and supportive campus leaders can help students feel heard and that their voice matters on campus.



Sustaining the integration of photovoice remains an important focus of the research methods course; however, maintaining relevance for the campus over time, and sustaining the goal of influencing decision makers, present more challenges. As campus planning moves forward, the same process may be less effective at helping to influence decision making. However, occasional conversations with campus staff and administration could serve to identify ways that the work can evolve and remain relevant. One emerging way that students may contribute to campus planning is to conduct photovoice analyses with attention to any differences linked to student background and experiences, such as from first generation college students, or by racial or ethnic groups. Results from previous semesters have already shown some variation, with Chicax students more often preferring agaves or other plantings that remind them of Mexican culture, or rural and first generation and low-income students seemingly more inclined toward maintaining or amplifying the military history on campus. Students in future courses could explore variations in preferences based on some of these factors.

An unintended consequence of this work was that at least some students began to consider, with some sense of agency, how environments can support their own health and mental restoration. This was observed through informal discussions between students and by explicit statements to the instructor that students now recognize and sometimes seek out specific spaces that are restorative for health. The project thus had the effect of influencing some metacognitive awareness about spaces that promote wellness. Some of the students said that it made them view the campus in a completely different way. This was in some ways beneficial but also led to them seeing some of the negative aspects of campus, like classrooms with no natural lighting and poor design. This made them aware of how much they disliked certain spaces, and some expressed frustration at not being able to “unsee” the campus in this way.

Seitz and colleagues (2014) found that many students expressed feelings of “being away” as important for stress alleviation. In some cases, our research similarly supports this (Figure 6), but we also found that there were many forms of restoration possible in the heart of a campus setting, in particular through views of nature, natural light, and pleasant walking and sitting spaces that are integrated into the built environment.



Figure 6. “Being Away” was sometimes mentioned by students but not as often as the built environment features that they were able to experience more regularly. This photo shows students’ view that “Wilderness on campus supports stress relief.”

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