



BIOPHILIC DESIGN EXPLORATION GUIDEBOOK

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LIVING BUILDING
CHALLENGESM 3.1

A Visionary Path to a Regenerative Future



INTERNATIONAL
LIVING FUTURE
INSTITUTESM

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INTRODUCTION

The International Living Future Institute has developed this guidebook to help Living Building Challenge project teams develop more biophilic projects and comply with the requirements and intent of Imperative 09 – Biophilic Environment. The resources include this general overview, as well as descriptions, outlines and tips for the required elements of the Imperative.

IMPERATIVE 09 BIOPHILIC ENVIRONMENT

I-09 REQUIREMENTS

The project must be designed to include elements that nurture the innate human-nature connection. Each project team must engage in a minimum of one all-day exploration of the biophilic design potential for the project. The exploration must result in a biophilic framework and plan for the project that outlines the following:

- How the project will be transformed by deliberately incorporating nature through Environmental Features, Light and Space, and Natural Shapes and Forms.
- How the project will be transformed by deliberately incorporating nature's patterns through Natural Patterns and Processes and Evolved Human-Nature Relationships.
- How the project will be uniquely connected to the place, climate and culture through Place-Based Relationships.
- How the project will provide sufficient and frequent human-nature interactions in both the interior and exterior of the project to connect the majority of occupants with nature directly.

The plan must contain methods for tracking biophilic design at each design phase. The plan should include cultural, ecological and climatic studies that thoroughly examine the site and context for the project.

“Biophilic design is the deliberate attempt to translate an understanding of the inherent human affinity to affiliate with natural systems and processes—known as biophilia—into the design of the built environment.”

Stephen Kellert

Biophilic Exploration Guidance

This document consolidates ideas about the structure, content, and goals of Biophilic Explorations as required by the International Living Future Institute for Living Building Challenge v3.1 (LBC) Imperative 09, Biophilic Environment (I-09). The information provided is also applicable to other biophilic design explorations or charrettes.

RECOMMENDED STEPS

The below steps represent a recommended approach to planning and executing a biophilic exploration for a capital project, including information that is specific to LBC I-09, compliance. Descriptions and recommendations for each step are provided below.

- 1) Prepare for Exploration
 - Research and exploration of the site, ecology and stakeholders
 - Identify workshop attendees and roles
 - Design exercises
 - Determine homework
 - Create agenda
- 2) Hold Charrette
 - Introductions and setting the tone
 - Agree on goals
 - Explore
 - Context
 - Biophilic design via Kellert's framework
 - Brainstorming ideas
 - Integrate into the project
 - Outline next steps
- 3) Develop Key Documents
 - Document the exploration
 - Write up Framework
 - Write up Plan
- 4) Implement Framework and Track the Strategies
- 5) Document Implementation

“Engage a biophilic design consultant who can work with your team. Think about what Biophilic Design elements make the most sense for this place, this purpose, and this time. Approach this as a non-checklist point of view—change your perspective, embrace Biophilia.”

Richard Piacentini, *Executive Director,*
Phipps Conservatory and Botanical Gardens

1. PREPARE FOR EXPLORATION DAY

The Biophilic Exploration Day should happen early in the design process, before concepts and forms are set. The exploration is most effective when it is the start of a collaborative process and when there are broad opportunities to “do things differently” and take risks without contravening work that has already occurred. Challenging accepted processes, norms, and hierarchies of decision making is beneficial to finding imaginative and effective solutions to biophilic goals, and participants will be more open and able to work toward such new solutions if they have not already spent time designing the project and getting deeply involved in the details of programmatic concerns. Biophilic design works best if it is the starting point for the concept for the project.

RESEARCH INTO THE SITE, ECOLOGY AND STAKEHOLDERS

A deep understanding of site context, including the history, culture, ecology and climate of the site, are essential to creating a biophilic building. The history, culture, ecology, and climate of the site are key to the exploration and the team should involve key experts and stakeholders ahead of time in order to sufficiently incorporate the resulting information into their day of exploration. Teams should take the time to know the site intimately—physically, spiritually and emotionally—in order to best explore the biophilic opportunities for the project.

Case Study

R.W. Kern Center

Amherst, MA, United States

Registered Project

FLOODING OF LIGHT

The Kern Center team’s commitment to biophilic design was maintained from design through construction with regular workshops that included the design team, faculty, staff and students who would ultimately call the Kern Center their own.

The project plays with light, space and hierarchy to create both a sense of place and of movement. The building’s shallow width and its north/south orientation allow every part of the building to be flooded with natural light, as well as creates a visual connection through the building.

The two-story glazing wall allows sunlight to penetrate deep into the atrium space, creating shadows that change during the day and throughout each season while offering broad views of the dramatic Holyoke Range. The high ceilings and proportion of glazing in the atrium creates a sense of spaciousness, where the walls disappear and the ceiling seems to float above. This lightness contrasts with the more enclosed and private spaces in adjacent office wings, creating a sense of progression and hierarchy through the building.

Photo: Courtesy of Bruner/Cott Associates

The intent is not for the design team to research the site and bring only their analysis, but to include in the research other stakeholders that approach problems differently. This research could include efforts by experts other than designers and can apply a different lens to the project context, such as biological or building science research methods. The team should identify outside resources that might be of particular relevance to the project such as owner or stakeholder values, site context, programmatic requirements, or other factors, but also think broadly about how to expand the information and views in the room. Identified expertise, resources, and issues can inform not only the participation list for the charrette, but also the agenda and the development of exercises to encourage new approaches.

IDENTIFY WORKSHOP ATTENDEES AND ROLES

Attendees for the exploration day should also include a broad spectrum of stakeholders and perspectives, while limiting the numbers to maintain a sense of focus on the project and allow deep participation by attendees. Re-thinking the attendee list beyond those that might attend a typical design charrette is meant to deepen understanding of opportunities and encourage project teams to incorporate the six Biophilic Design Elements in innovative and effective ways. It is important the team think about professions and expertise outside of the typical project team and how such additions might enrich the conversation and collection of perspectives in the room.

Brief presentations about history, culture, or ecology can be helpful to share knowledge and spark participation and new ideas. An outside facilitator will free up the design team to fully participate in generating ideas and discourage a focus on preconceived design concepts.

Some professions to consider inviting as either presenters or participants are listed below.

Attendee Suggestions

Design team members	<ul style="list-style-type: none"> Architect Landscape Architect Civil Engineer MEP Engineers 	<ul style="list-style-type: none"> Structural Engineer Sustainability Consultant Lighting Designer Acoustic Designer
Direct stakeholders	<ul style="list-style-type: none"> Owners/ Decision Makers Occupants 	
Environmental Features Naturals Shapes and Forms Light and Space	<ul style="list-style-type: none"> Geologist Botanist Environmental Analyst Ecologist / Naturalist 	<ul style="list-style-type: none"> Meteorologist Biomimicry Specialist Geomorphologist Artists
Natural Patterns and Processes Evolved Human-Nature Relationships	<ul style="list-style-type: none"> Material Scientist Biologist Landscape Architect Natural Historian 	
Connection to place, climate, and culture through Place-Based Relationships	<ul style="list-style-type: none"> Community Leaders Historic Preservation Consultant Social Ecologist Anthropologist 	<ul style="list-style-type: none"> Local Historian (e.g., from a local university)

DESIGN EXERCISES

Workshop exercises are meant to get attendees out of standard lecture or meeting mode. The exercises should be designed to draw attendees beyond their typical role toward deeper, more personal participation. They might include a physical element that literally stretches or moves the participants. They might try to tap into memories or subconscious reactions to bring innate responses to the surface. Some examples and best practices are provided below. However, the team should not be limited by specific formats, but should think about what might deeply engage participants and set the right tone for their particular biophilic exploration.

The number of exercises, their timing, and format will be different based on the project—its type, context, and stakeholders. That said, there are some recommended best practices. It is generally helpful to connect the concepts of biophilic design to personal experiences, and it is important to help participants understand Kellert's concepts and apply them to the project.

Most participants will be at the charrette in a professional capacity which may keep them in their professional role, focusing on typical issues such as design concerns and solutions, code compliance, or costs. Exercises are a powerful way to pull people out of those standard roles into more deeply based areas of response. The exercises have three general goals: to connect participants with their subconscious, or nature-based selves; to connect dots between personal experience and biophilic design principals; and to spark creativity that contributes toward innovative biophilic design.

Teams are encouraged to review the exercise examples provided below, and also to customize and innovate exercises that suit their project and process.

DETERMINE HOMEWORK

It is a good idea to assign homework to participants before the charrette (see Resources for a list of recommended materials). Arriving at the charrette with a basic understanding of biophilic design helps move the agenda into the specifics of the project more quickly. Another homework option is to focus on the reflection of personal connections to nature and/or to bring a natural object that represents that connection.

At a minimum, some short articles on the connection between people and nature, a self-reflection exercise about each person's own connection to nature, or a list of Kellert's Elements and Attributes should be sent before the exploration day.

CREATE AGENDA

It is possible to have a successful Biophilic Design Exploration with a very structured or very loose agenda, as long as it allows for comfortable participation by participants and moves the project toward successful integration of Kellert's principals.

TIP

Writing down ideas on sticky notes and having participants place them where everyone can see encourages those who may not be comfortable sharing their ideas out loud to the group.

TIP

Adding a personal element to the discussion can help participants arrive in the mindset of how people and nature are connected.

RECOMMENDED AGENDA ITEMS

The below agenda items are recommendations. They do not all have to be included, and may be executed in a different order or given a different emphasis than outlined here. The recommended items listed below are then annotated in the following sections.

- A. Introductions and Setting the Tone
- B. Goals of the Exploration
- C. Complete Initial Exercise
- D. Explore Context
 - Place Context
 - People/Culture Context
 - Project Context
- E. Investigate Biophilic Design
- F. Integrate Discoveries into the Project
- G. Additional Exercises (throughout day)
- H. Outline the Document

2. Hold Biophilic Design Exploration

The exploration goal is to align stakeholders around specific biophilic design goals and outcomes, and for participants to feel personally invested in connecting the building and occupants to nature.

A. INTRODUCTIONS AND SETTING THE TONE

The Introduction should focus on each person's personal connections to nature. Without each person bringing that perspective into the room, the openness to considering biophilic design strategies will be restricted. Questions participants might answer when introducing themselves include:

- What is the most inspiring moment you have ever experienced in nature?
- How does nature influence who you are?
- Describe a natural object and why it is meaningful to you (or tie into homework).
- Which built space have you been the happiest in?

Suggested rules for the day:

- Project teams are encouraged to approach biophilic design with an experiential intent and understanding of cooperation and valuable contribution of ideas.
- Think outside of the box.
- Encourage collaboration and broad brainstorming; "There are no bad ideas."
- Build on other's ideas; suggest using "Yes, and..."
- Work to "co-create" biophilic design solutions—perhaps give credit for "the assist."
- Try to weigh in on areas of the project beyond your typical scope of work.

TIPS

Think about poetry, go out on a limb, inspire pause and action.

One conversation at a time. Your team is far more likely to build on an idea and make a creative leap if everyone is paying full attention to whoever is sharing a new idea.

B. AGREE ON GOALS

The International Living Future Institute has goals for the Biophilic Exploration Day which are stated below. The team, however, will determine their own specific goals for the day based on the current project status, context, type and stakeholders. We recommend the team be familiar with ILFI's requirements, and work with their participants to finalize their goals.

ILFI's Goals

Stakeholders to develop ideas that will support the project with regard to biophilic design. By the end of the day, attendees will have a clear understanding of Stephen R. Kellert's Elements and Attributes and agreement on how they can be a source of support and enrichment for the project. The ideas developed during the workshop will become the basis of the project's Biophilic Design Framework.

Project's Exploration Goals

The project team has an opportunity, in the exploration goals, to focus attention on the four requirements of the Imperative, get buy-in from all attendees, and set other project objectives related to biophilic design. It may be helpful to establish goals + objectives for the day through guiding questions. Some examples are provided below. The team may want to get consensus on the process for determining goals for the day.

Example guiding questions:

- How familiar are participants with the principals of and research around biophilic design?
- How does biophilic design support the larger mission of the owner?
- How might biophilic design support the goals of the occupants or the surrounding community?
- How will the exploration influence the overall design process?

Example Exploration goals:

- To get buy-in for biophilic design/LBC Imperative goals for the project
- To explore opportunities for engaged inclusion of all attendees and stakeholders
- To identify how the requirements will drive the design concept
- To identify the intent and objectives of biophilic design for this project
- To brainstorm and explore biophilic design as a process
- To hear input from stakeholders that are not on the design team
- To provide a high-level overview of biophilic design principals for attendees/stakeholders
- To explore, identify, interpret, and strategize the application of biophilic design for the project
- To understand the unique patterns of the place through biophilic principals

C. COMPLETE INITIAL EXERCISE

The initial exercise is an opportunity to enable a connection and open mindset amongst participants, to accept new ideas, reconnect with their innate and deeply rooted relationship with nature, and to introduce the biophilic frame of mind.

More information on Exercises is provided in section F.

D. EXPLORE CONTEXT

Explorations typically include a combination of prepared information and spontaneous additions to take advantage of and elicit the tacit wisdom. An experienced facilitator will help keep this section running smoothly while adapting to the unique interactions of the particular make-up of participants.

Historical, cultural, ecological, and climatic studies that thoroughly examine the site and context should be included in the project team's research and information for the exploration day.

PLACE CONTEXT

Get input on relevant site context, then discuss the purpose of the project and the context of the project site. This part of the agenda would typically include brief presentations of research into the site context, such as the ecology, climate, geography, etc., including visuals, either live (if able to visit the site) or through other media. Ideally, this section also includes information about why the site is unique or typical for the area or the project type, or its significance. Look for opportunities within the location:

- What is a regional material palette?
- Which other senses could come into play: color palette, tactile palette, auditory palette, etc.
- How do current occupants respond to both climate and weather? Time of day?
- How does this ecosystem work? What is unique about it?
- How can people be connected to the climate and ecosystem of this place?
- What ecosystem services are available, and what other values do they bring (aesthetic, physical, auditory, etc.)?

Case Study

Te Kura Whare *Tūhoe, Tāneatua, New Zealand* **Living Certified Building**

PRESERVING CULTURE

Te Kura Whare serves as a community center and central point of connection for the Ngāi Tūhoe, a tribe, whose ancestral lands include the steeply forested Te Urewera on New Zealand's North Island.

Te Kura Whare, the Tūhoe was part of an effort to restore the relationship between the Tūhoe people, their culture and the land. Te Kura Whare coexists in harmony with the surrounding environment in part due to an extensive collaboration between the design team and the Tūhoe. Tūhoe believe it is their responsibility to nurture, learn from and respect the land.

The simple materials palette creates a strong connection with the land and roots the building to its place. Te Kura Whare is built from wood harvested from forests that are now managed by the Tūhoe people, and the internal walls are composed of five thousand clay bricks that were created on-site as part of a training program for the community. The opportunity to fashion earth and wood from their ancestral lands into timber and bricks that provide a protected space for gathering created memorable experiences which will forever tie the Tūhoe community to the project.

Photo: Anna Dermer

PEOPLE/CULTURE CONTEXT

The goal of this section is to understand how to create community both in the finished project and in connection to the community it is within. Community connections can happen throughout design, as well as after project completion. Consider who is likely to be using the building and what their relationship to the site, history, and community will be.

Exploring cultural variation in the context of biophilic responses to space, light, color, or other sensory differences will be helpful in the design of space and will help to elicit the emotive aspects of the project.

- How can community be created in this place?
- What are the cultural strengths of this place? How can they be celebrated?
- How can the building occupants be connected to nature from the minute they arrive?
- What are the journeys and interactions with nature from arrival to departure? How do they vary for different occupants?
- Where and how can people celebrate their connections to each other?
- What are the historical and/or cultural influences?
- What are the cultural implications or lessons that might influence the regional palette or be reflected in the spaces?

PROJECT CONTEXT

While it is important to have a general understanding of the project (reason for it occurring, priorities of the program), this section can run the risk of setting a particular focus that limits brainstorming and taking risks. It is wise to limit the time and scope of this section by keeping information general and inspirational, rather than getting very detailed and practical.

- What are the key areas for flexibility or responsiveness, to climate, weather, or occupants?
- How will the aesthetics of the project contrast and/or reflect the existing context?
- How can the project's original goals be supported and enhanced through biophilic design?

E. INVESTIGATE BIOPHILIC DESIGN

The objective in this section is for everyone to understand what biophilic design is, how it has been categorized and explained by Stephen Kellert and how other projects have used it to create biophilic buildings.

Biophilic design is about connecting people to nature—this objective in mind will help the group stay focused on strategies that engage the building form, materials, spatial responses, and psychological responses to space rather than simply inserting a few green walls or providing natural daylight. These are both great strategies but alone do not create a biophilic building.

Explore each of Kellert's six elements through an exercise and/or brainstorming activity. Be cautious of providing very specific examples that will narrow teams' imaginations. Depending on the project, group, and structure of the exploration day, this section could be the core of the day, generating a myriad of ideas that are later tied to the project, or it could be more of an educational segment that is applied to brainstorming and the specifics of the project later in the day.

TIP

Reporting out by one person can help share information, but it also can result in editing by the "reporter". Consider multiple "reporters" per group.

BIOPHILIC DESIGN ELEMENTS AND THEIR CORRESPONDING ATTRIBUTES

Environmental features <ul style="list-style-type: none"> • Color • Water • Air • Sunlight • Plants • Animals • Natural materials • Views and vistas • Façade greening • Geology and landscape • Habitats and ecosystems 	Natural shapes and forms <ul style="list-style-type: none"> • Botanical motifs • Tree and columnar supports • Animal (mainly vertebrate) motifs • Shells and spirals • Egg, oval, and tubular forms • Arches, vaults, domes • Shapes resisting straight lines and right angles • Simulation of natural features • Biomorphy • Geomorphology • Biomimicry 	Natural patterns and processes <ul style="list-style-type: none"> • Sensory variability • Information richness • Age, change, and the patina of time • Growth and efflorescence • Central focal point • Patterned wholes • Bounded spaces • Transitional spaces • Linked series and chains • Integration of parts to wholes • Complementary contrasts • Dynamic balance and tension • Fractals • Hierarchically organized ratios and scales
Light and space <ul style="list-style-type: none"> • Natural light • Filtered and diffused light • Light and shadow • Reflected light • Light pools • Warm light • Light as shape and form • Spaciousness • Spatial variability • Space as shape and form • Spatial harmony • Inside-outside spaces 	Place-based relationships <ul style="list-style-type: none"> • Geographic connection to place • Historic connection to place • Ecological connection to place • Cultural connection to place • Indigenous materials • Landscape orientation • Landscape features that define building form • Landscape ecology • Integration of culture and ecology • Spirit of place • Avoiding placelessness 	Evolved human-nature relationships <ul style="list-style-type: none"> • Prospect and refuge • Order and complexity • Curiosity and enticement • Change and metamorphosis • Security and protection • Mastery and control • Affection and attachment • Attraction and beauty • Exploration and discovery • Information and cognition • Fear and awe • Reverence and spirituality

“We now know about integrative design, about regenerative design—where you’re not trying to do a green building but a building that heals the ecosystem and the social system that you’re dropping in into. It turns it away from being the object [and] into the relationship.”

Jerome Partington,
Senior Associate, *Jasmax*

Some biophilic principles are easier to understand and implement than others. It may be helpful to focus specific attention, through an exercise, or by focusing on elements that are less familiar to participants that could spark particularly innovative responses. One strategy would be to explore the less typical integrated elements through an exercise, then discuss and try to come up with ideas specific to the project.

For example, Evolved Human-Nature Relationships, and Natural Patterns and Processes are more psychological, and less explicitly physical than Natural Shapes and Forms or Light and Space. Teams will benefit from going beyond the “low-hanging fruit” that fits into their standard design process (e.g., incorporating natural light and natural materials), to have fun and explore broad options. For example, spaces that are “mysterious” or “scary” are not easily defined by specific physical interventions but can be memorable and stir very strong responses. Similarly, the emotive impact of successful creation of “dynamic balance and tension” or “fear and awe” could be significant.

TIPS

Go for quantity. Aim for as many new ideas as possible. In a good session, up to 100 ideas are generated in an hour. Crank the ideas out quickly and build on the best ones.

Eliciting comments during “reporting out”, or in a “popcorn style”, or “from those who haven’t yet spoken” may expand the pool of input.

F. INCORPORATE EXERCISES

Each eight-hour charrette could have anywhere from two to four exercises depending on the type and length. The exercises should be structured to take the group from thinking big picture about biophilic design to narrowing down and focusing on strategies for the project and how they will be integrated.

EXERCISE EXAMPLES

Explore Multi-Sensory Design

- Direct Sensory Perception (interactive session)
 - **Description:** Explore possible interventions in our building environment that can enhance our sensory environments to create well-being or happiness.
 - **Methodology:** Focus on the often-neglected sensory environment, especially non-rhythmic sensory stimulation for hearing, vision, and thermal delight.

Explore the Biophilic Design Elements and Attributes

- Indirect Psychological Perception (interactive conversations)
 - **Description:** Explore interventions in our built environment that can connect people and nature.
 - **Methodology:** Now shifting the focus to the biophilic design elements and attributes, reflect on their definitions, how they subconsciously engage our psyche, and how their design application can be implemented in the project to stimulate all five senses.

Integration into Practice

- Specific project visioning
 - **Description:** Explore opportunities to bring biophilic design elements to life.
 - **Methodology:** Recognizing that the specific context matters a great deal when applying biophilic design elements, reflect on the direct sensory perception and the indirect psychological perception exercises and share insights on how they may be demonstrated in buildings and how to build this into a design practice.

G. INTEGRATE BIOPHILIC DESIGN

It is critical that Kellert's elements and attributes are applied to the project and the team walks away from the Exploration with strategies and design concepts that allow the project to incorporate biophilic design and to meet the requirements of Imperative 09.

The most successful projects address biophilia through a mix of the below principals.

- Integration and Connection: Biophilic design that reinforces design interventions for a direct connection to the project setting or space.
- Expression and Emotion: Biophilic design that demonstrates and stirs affection toward project setting or space.
- Experience of Nature: Biophilic design that fosters positive, everyday interactions and relationships with the natural environment.
- Physiological Benefit: Biophilic design that emphasizes human health, fitness, and well-being.

Consider various scales, impacts, locations, types

- Landscape strategies
- Building form
- Paths and movement
- Finishes and detailing
- Opportunities to engage the senses (tactile, auditory, olfactory, etc.)

Consider interactions/dependencies

Identify strategies that will allow a variety of interactions/dependencies.

- Centralization + Decentralization: What functions can be integrated and which need to be separated?
- Flexibility: What are the expected changes of functions over time?
- Flow: Who and/or what moves through the project; goods, services, people.

H. OUTLINE NEXT STEPS

Ideally, the exploration will leave time at the end to outline and agree on the basic elements of the biophilic framework and biophilic plan, described below.

By the end of the exploration day, participants should know:

- The agreed-upon goals and themes for the project
- Which Kellert elements will be prioritized by the project team
- Specific strategy ideas to meet the I-09 requirements—and which of those require more research

3. DEVELOP KEY DOCUMENTS

Clear documentation is critical to a successful certification. The team should retain relevant information from the exploration, as well as from meetings to track, refine, or revisit biophilia.

DOCUMENT THE EXPLORATION

The project team should keep good records of the attendees, agenda, discussions, inputs and outcomes of the Biophilic Exploration. The outcomes will become the Biophilic Framework, the attendees and agenda should be included in Imperative documentation, either as a record in the Framework or as separate documents. Notes and photos of the inputs and decisions can be helpful for the development of the framework and plan, or if questions arise during the implementation of the biophilic design elements.

Recommended documentation:

- Agenda (could be in Framework as a record)
- Attendee List (could be in Framework as a record)
- Input and decisions (notes, photos, etc)

CREATE THE BIOPHILIC FRAMEWORK

The project's Biophilic Framework outlines the decisions from the exploration: what strategies the team will integrate into the project, what will be investigated further, what significant decisions need to be made to meet project goals. The framework will evolve throughout the project, but should still remain largely based on the results of the exploration day.

Based on workshop outcomes (who, by when, how detailed for this project) some subsection of participants should create the official framework. Ideally, all participants would have an opportunity to review and comment on that final framework.

THE FRAMEWORK

- A goal-oriented document that focuses on desired outcomes
- Summarizes the approach of the team toward the integration of biophilic design into the project
- Should be understood by participants, as well as outside parties such as, other teams hoping to learn from the project and the IFLI Auditor, and could eventually be included in education materials about the project

TIP

Written notes from multiple authors can help ensure ideas aren't missed.

Review of the consolidated notes by all participants may provide a beneficial feedback loop.

Case Study

Sustainable Buildings Research Centre Wollongong, Australia Registered Project

LANDSCAPE RELATIONSHIP

The Sustainable Buildings Research Centre (SBRC), part of University of Wollongong's Innovation Campus, was created to test and demonstrate technologies to inspire the green building movement in Australia.

The design creates journeys to engage all the senses and invites students, staff, and visitors to explore and experience the Centre. The varied textures and patterns in the building materials and landscape plants encourage people not just to look, but to touch and feel. Occupants are encouraged to harvest and taste the fruits and vegetables from the garden. The courtyard is filled with birdsongs and sounds of the wind rushing through the landscaping plants. During summer and spring, building interiors fill up with the fresh fragrances from the mountains, the tang of coastal dune plants, and the scent of citrus blossoms.

Programming is divided between two buildings, with landscaped areas in between, ensuring that occupants will spend at least part of their day outside. These pedestrian journeys combined with framed views and long vistas from the interior foster direct and indirect connections with nature.

Photo: John Gollins

CREATE THE BIOPHILIC PLAN

The plan is meant to ensure the project implementation of the Framework stays on track.

THE PLAN

The plan is a guiding document that helps the team implement the Framework to meet the project's biophilic design goals. It lays out how to integrate the selected biophilic strategies into the project throughout all phases. The plan could lay out communication paths and methods, milestones, next steps with responsible parties, and methods to track each element throughout the project. The plan could also be based around an actual plan of the site/project—pointing out planned interventions and tracking them at each phase to ensure they remain intact or evolve in a way that supports both the project and Imperative requirements. The plan is:

- An execution-oriented document
- Focused on strategies and steps the team will use to implement the framework throughout the project
- A means to help the team stay on track toward their biophilic design goals

The plan might include:

- Action items (by person or group)
- Timelines and deadlines
- Communication strategies—both within the team and to outside stakeholders
- Prioritization and/or decision-making methodologies
- Documentation of implementation—i.e., visual plan, plan of execution

4. IMPLEMENT THE FRAMEWORK

Using the plan, the team must integrate sufficient biophilic design strategies from the framework to meet at least the minimum Imperative requirements—integration of the required elements of Kellert's framework—into the project. It is effective to have biophilic design integrated throughout the project site and buildings—working in harmony with other design goals. Ideally each goal will be met through strategies that are accessible to a majority of occupants and/or visitors to the building.

The documentation of the framework implementation should include locations, images and brief descriptions of each installed or constructed strategy, at a minimum. Non-visual strategies, such as auditory or tactile interventions, might require minimal imagery and slightly longer descriptions.

5. TRACK THE IMPLEMENTATION

The team should track each of the goals from the exploration day throughout the design and construction process to ensure that they are met. The means to track can be determined by each project's team and circumstances, but should be documented in a clear and simple way. Documentation might include a series of design/construction drawings, written progress reports, or other visuals. Tracking recommendations include:

- Check-ins at each stage of design to confirm goals are still being met
- Written and/or visual documentation of status of goals at each check-in
- Visual documentation of final implementation

DEFINITIONS

Biophilia

The innate, genetically determined affiliation of human beings to nature and other living organisms.

Biomimicry

The copying or imitation of the phenomenon's occurring in nature or an environment's efficiency and survival mechanisms in manufacturing processes (in applied case-based reasoning).

Fractals

A figure of surface generated by successive subdivisions of a simpler polygon or polyhedron, according to some iterative process.

Genius of Place

A Genius of Place looks to nature in a particular place to provide guidance on locally attuned design strategies. By asking, "How have organisms and ecosystems solved this challenge here?" we discover a suite of design strategies that are well-adapted to place.

Geomorphology

The study of the characteristics, origin, and development of landforms.

RESOURCES

BOOKS

Project teams have demonstrated a better understanding of biophilic design after researching the following precedents:

Creating Biophilic Buildings

Amanda Sturgeon, FAIA (Ecotone Publishing, 2017)

Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life

Stephen R. Kellert, Judith Heerwagen, and Martin Mador (Hoboken, NJ: Wiley, 2008)

Building for Life: Designing and Understanding the Human-Nature Connection

Stephen R. Kellert (Washington, DC: Island Press, 2005)

The Power of Limits: Proportional Harmonies in Nature, Art, and Architecture

Paperback – October 11, 2005, by Gyorgy Doczi

MOVIE

Biophilic Design: The Architecture of Life

Directed by Stephen R. Kellert and Bill Finnegan. Tamarack Media, 2011. DVD.

TERRAPIN REPORTS

The Economics of Biophilia: Why designing with nature in mind makes financial sense.

Terrapin Bright Green. 2014.

<https://www.terrabinbrightgreen.com/report/economics-of-biophilia/>.

14 Patterns of Biophilic Design: Improving Health and Well-Being in the Built Environment.

Terrapin Bright Green. 2014.

<https://www.terrabinbrightgreen.com/report/14-patterns/>.

Biophilic Case Studies.

Terrapin Bright Green. 2015.

<https://www.terrabinbrightgreen.com/report/biophilic-design-case-studies/>.

Biophilia & Healing Environments: Healthy Principles for Designing the Built World.

Salingaros, Nikos & Ryan, Catherine. 2015. Terrapin Bright Green & Metropolis Magazine.

<https://www.terrabinbrightgreen.com/report/biophilia-healing-environments/>.

RESEARCH

“Inducing physiological stress recovery with sounds of nature in a virtual reality forest — Results from a pilot study.”

Annerstedt, Matilda, Peter Jönsson, Mattias Wallergård, Gerd Johansson, Björn Karlson, Patrik Grahn, Åse Marie Hansen, and Peter Währborg. *Physiology & Behavior* 118 (May 2013): 240-50. doi:10.1016/j.physbeh.2013.05.023.

“Workplace Wellness Programs Can Generate Savings.”

Baicker, K., D. Cutler, and Z. Song. *Health Affairs* 29, no. 2 (February 2010): 304-11. doi:10.1377/hlthaff.2009.0626.

“The influence of school architecture on academic achievement.”

Tanner, C. Kenneth. *Journal of Educational Administration* 38, no. 4 (February 2000): 309-30. doi:10.1108/09578230010373598.

“When we go to see a dance performance and the dancer makes a gesture, we experience something: maybe bird-like, maybe frog-like—something that’s not actually there. Buildings that are in touch with their locations—those that have been invested with heart by the people who design and make them—do that. They’re dynamic, living things.”

Jonathan Wright, *Construction Manager,
Wright Builders Inc.*



LIVING BUILDING CHALLENGE 3.1

A Visionary Path to a Regenerative Future

<https://living-future.org>
lbc.support@living-future.org

November 2017



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