Chapter 19

Integrating LEED with Biophilic Design Attributes

Toward an Inclusive Rating System

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19.1 Introduction

Excessive carbon emissions and the depletion of nonrenewable resources continue to inflict increasingly harmful impacts on human populations and on the planet (Intergovernmental Panel on Climate Change 2014). To meet this global challenge, evaluation systems look to encourage understanding of architecture's role in the health of the environment. These assessments are often governed by a points-driven rating system whereby a candidate building and its immediate site and neighborhood are assessed based on energy consumption, building materiality, landscaping, linkages to public transit, water conservation practices, and related "green" characteristics (USGBC 2018a).

Healthcare provider organizations, who typically commission new and renovated healthcare facilities in the public and private sectors of the industry, often value these assessments' seals of approval, regardless of whether they are fully understood. Architects are increasingly using the Leadership in Energy and Environmental Design (LEED) system to denote a building's sustainability, and by proxy its overall architectural design quality in the eyes of its user/occupants. In reality, however, LEED does not seek to directly address, or measure in any way, a given healthcare facility, its campus, or its neighborhood environs from the perspective of its inhabitants' well-being. It is this miscalculation, that sustainability automatically results in user well-being, that must be addressed. Sustainability, while certainly correlated to well-being, needs to be viewed through a broader, more inclusive multidimensional construct than through the measurement of sheer energy conservation (Guenther and Vittori 2013). In short, architecture must no longer view energy-conscious design as existing within a vacuum; instead it must also acknowledge the well-being of its users/occupants.

19.2 Global Rating Systems

Over the past quarter century, numerous rating systems have appeared on the scene, anchored by the four most commonly used rating systems: LEED started in the United States, now used globally, including in Canada (since 2000); BRE Environmental Assessment Method (BREEAM), in the United Kingdom (since 1990); Comprehensive Assessment System for Built Environment Efficiency (CASBEE), in Japan (since 2001); and Green Star, in Australia (since 2003). In tandem, many less frequently used certification standards have gained influence, including HK-BEAM, in Hong Kong (since 1996); Passive House, in Germany (since 1996); Green Mark Scheme, in Singapore (since 2005); the Living Building Challenge, in the United States (since 2006); ASGB, in China (since 2006); DGNB, in Germany (since 2007); Active House, in Denmark (since 2013); and WELL, in the United States (since 2014).

LEED remains the most widely used rating system globally (Say and Wood 2008; Politi and Antonini 2017; USGBC 2018a, 2018b, 2018c), although it does not attempt to address, nor comprehensively evaluate, design excellence from the user/occupant's perspective. LEED is organized in seven categories:

- Sustainable sites: site selection, attributes, and associated infrastructure
- Water efficiency: water retention and conservation measures
- Energy and atmosphere: minimized energy consumption and commissioning protocols
- Materials and resources: ecological construction and materiality practices and building longevity
- Indoor environmental quality: air quality levels, thermal comfort, daylighting, view amenity, and nontoxic material palettes
- Innovation and design process: ecologically attuned design strategies
- Regional priority: applying existing credits for bonus points based on geographic factors

The newest version of LEED is v4 (version 4) and, notably, it now categorizes indoor environmental quality, natural daylighting, and energy-conserving building materials under a "health and human experience" category (USGBC 2018c). LEED buildings, while proven to consume 24% less energy on average compared to their non-LEED-certified counterparts, still remain controversial in their anointment as sustainable. For instance, Newsham, Mancini, and Birt (2009) comparatively analyzed data from 100 LEED commercial and institutional buildings and found, on average, LEED buildings consumed 18%–39% less energy per floor area than their conventional counterparts. However, 28%–35% of these LEED buildings studied consumed more energy. Furthermore, measured building energy performance was found to be only minimally correlated with the LEED certification level bestowed—that is, the number of energy-saving credits awarded (Newsham, Mancini, and Birt 2009; Al-Zubaidy 2015).

With respect to healthcare facilities, one recent study used national cost report data from the U.S. Centers for Medicare and Medicaid Services to develop a benchmarking tool for comparing the operation and maintenance costs of healthcare facilities versus comparable non-health buildings. Thirty-two LEED hospitals were compared to the median cost of non-LEED hospital facilities of comparable type, ownership, and location. The LEED-certified healthcare facilities did not significantly lower annual operation or maintenance costs (Sadatsafavi and Shepley 2016). LEED-certified healthcare facilities are therefore by no means intrinsically associated with positive satisfaction or well-being outcomes for their occupants. This is especially the case as to the therapeutic affordances of engagement with nature, and with perceived indoor human comfort levels as a function of natural daylighting.

19.3 User Well-Being—Beyond Saving Energy

The most rapidly growing age cohort in societies around the globe is the demographic aged 65 and older, and especially the segment aged 85 and older (United Nations 2017). Significantly more attention needs to be devoted to this growing segment of society with respect to the quality of built environments for the provision of long-term care (Verderber and Fine 2000). In the past decade, multiple evidence-based research studies have drawn linkages between environmental design attributes and positive health outcomes among aged populations (Ulrich 1999; Ulrich et al. 2008). However, these developments have yet to find their way into the policies and best practices of healthcare provider organizations whose principal focus is long-term care (Chrysikou, Rabnett, and Tziraki 2016). Four types of 24/7 care facilities for the aged presently qualify for LEED certification: (1) independent living facilities; (2) assisted living (AL) facilities, where residents are provided with autonomous living quarters and can partake in communal spiritual, dining, and social activities; (3) skilled nursing long-term care (LTC) facilities with medical support on-site; and (4) LTC aging-in-place (LTC/AIP) facilities with the option of independent living, assisted living, and skilled nursing supports on-site.

Biophilic theories in architecture and its allied design professions stem from the late 1960s and the proceedings of the Environmental Design Research Association (EDRA). Founded in 1968, EDRA has continuously championed the value of built environments supportive of the functional needs and aspirations of the aged. Specialized offshoots of EDRA gradually appeared, notably the Center for Health Design (CHD). The CHD's Pebble Project, launched in 2000, has been noteworthy in terms of the use of the post-occupancy evaluation as a vehicle to include user/occupant assessment of the case study facility and its campus environs (Anon 2008; Taylor 2012). This area of applied research has gradually spilled over into professional practice, and has become nestled within the more broadly defined salutogenic design movement. The operative assumption here is that biophilic design is an important facet of built healthcare environments for the aged—a constituency that can greatly benefit.

That said, the aim of this investigation is threefold. First, a cross section of North American long-term care settings for the aged is examined by first identifying the criteria upon which a given facility is bestowed LEED certification at the silver, gold, or platinum level. Second, LEED's rating metrics are then examined in direct relation to a set of biophilic design attributes, or affordances. The third aim is to originate a composite LEED-Biophilic score for long-term care facilities and their campus environs based on the assumption this can significantly aid healthcare organizations in the commissioning and operations of higher-quality built environments for their stakeholder constituencies than at the present time. The current LEED metrics do include view quality, window operability, daylighting, and indoor air quality, but these factors are not assessed from the direct perspective of the user/occupant. In short, the basic research question is this: Is it possible to develop a set of facility-campus environ rating metrics that expand beyond LEED's present focus on energy-conscious planning and design attributes to take into account the nature-related satisfaction level and well-being of the user/occupant?

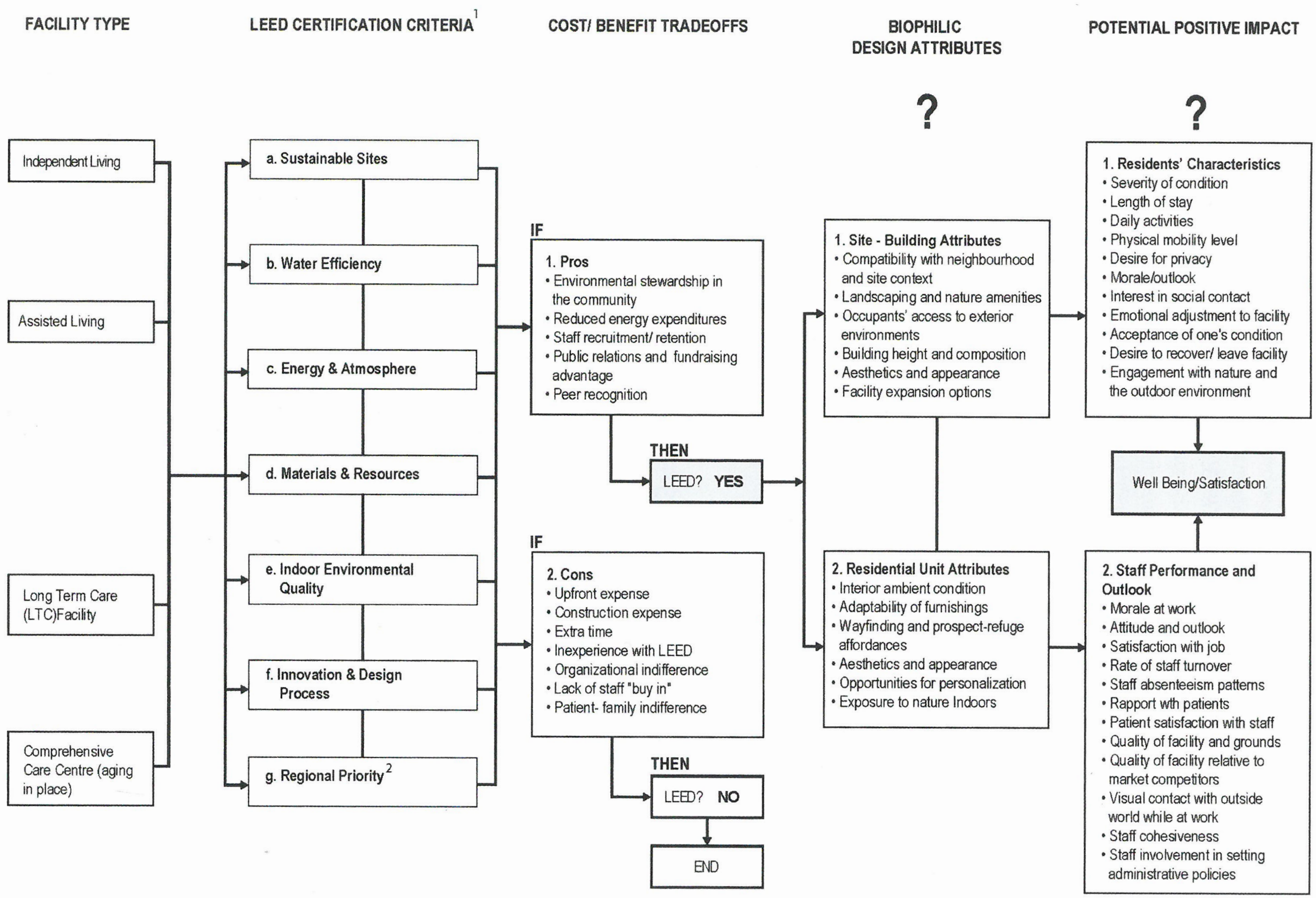
A healthcare provider organization must assess the cost/benefit trade-offs associated with pursuing LEED (Preiser, Hardy, and Schramm 2017). These include the organization's desired image in its community as an environmental steward from a public relations standpoint, its mission statement, its interest in reducing facility operational expenditures, whether LEED will enhance staff recruitment and retention, and whether LEED will result in enhanced status among peers within the industry. Disincentives, on the other hand, can include the considerable upfront cost of LEED registration, the increase in construction costs, and the lack of staff, patient, and family awareness of and experience with LEED or what it represents. At present, if a healthcare provider organization should decide to pursue LEED certification, a process ensues that may (or may not) result in a completed building and campus expressing salient biophilic architectural affordances. LEED alone, in its present configuration, therefore does not directly promote such affordances. The trade-off between LEED certification and non-LEED certification in relation to resident health status and well-being and staff outcomes is summarized in Figure 19.1.

19.4 Methodology

The aim of this investigation was to look closely at the relationship between biophilic design, associated health outcomes, site planning, and architectural attributes. A summary of biophilic design patterns and biological response recently published online in a report by the environmental consulting firm Terrapin/Bright/Green was referenced (2019). This report presents 14 biophilic design patterns variously connected to four health outcomes outlined here:

- Make a positive impact on user/occupant stress reduction and mitigation
- Increase user/occupant cognitive performance levels
- Improve user/occupant psycho-emotional outlook and behavior
- Heighten user/occupant satisfaction, perceived safety, and human comfort levels

This resulted in four site/building attributes, and five common area and resident room attributes, collectively grounded in 10 of the 14 biophilic design



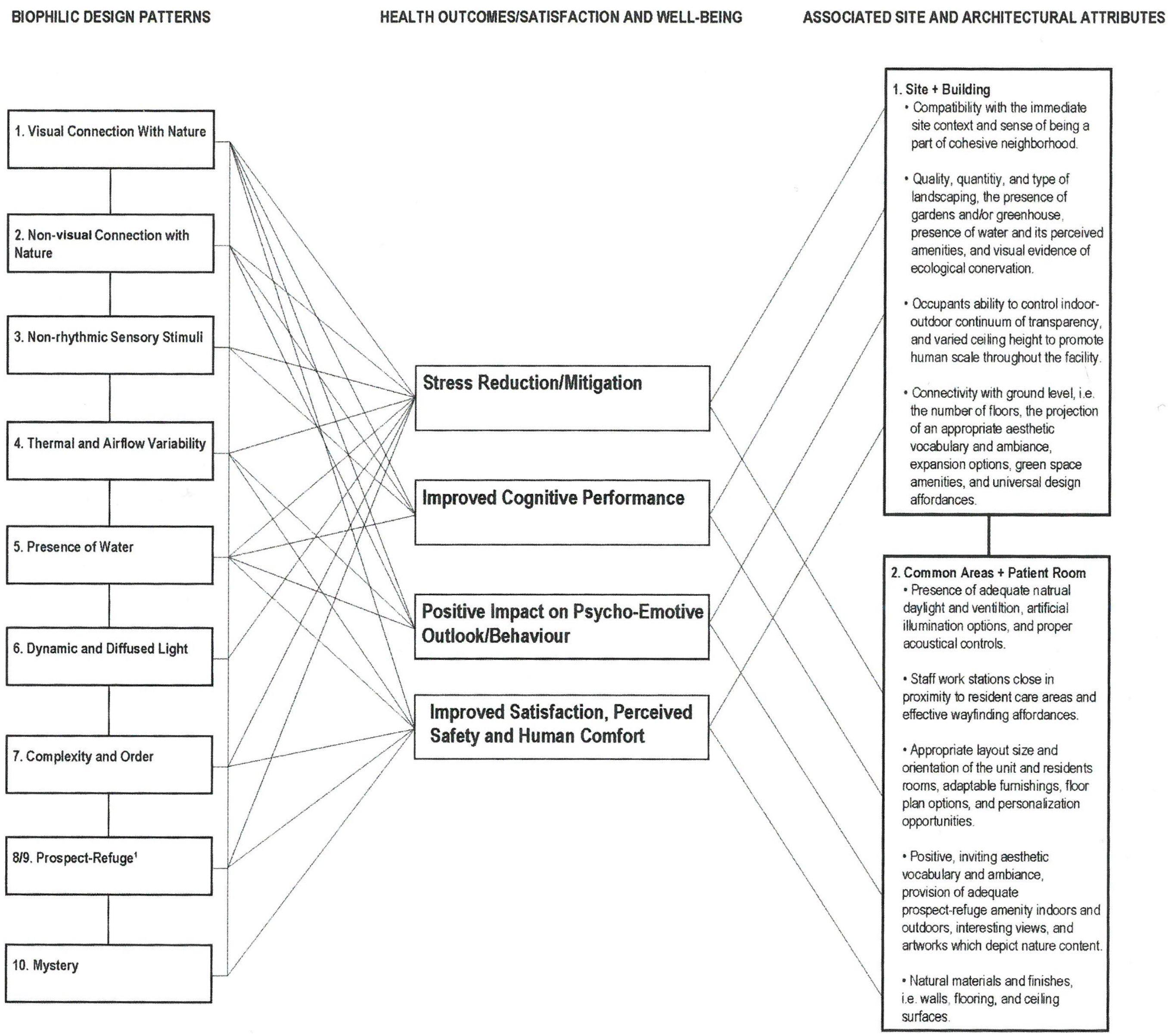
[1] LEED programs currently exist in the areas of health, new construction, renovation and interiors (a seventh category, Reciprocal Priority, constitutes up to 41 points, for a total of 110 maximum points)
[2] LEED version 2009

▲ Figure 19.1

LEED certification and health and well-being in residents and staff..

Source: Stephen Verderber, Terri Peters, Oussama El Assir, and Josh Silver

patterns cited in the aforementioned 2019 report. These nine environmental attributes were defined on the basis of a review of recent literature specifically focused on long-term care architecture and associated site environs within the field of architecture for health (Carstens 1993; Feddersen 2009; Anåker et al. 2017; Regnier 2018). This relationship between the theoretical and applied aspects of the investigational framework is summarized in Figure 19.2.



[1]Prospect and refuge patterns are combined here as a single construct.

▲ Figure 19.2

Relationships between site and building attributes and biophilic design patterns.
Source: Stephen Verderber, Terri Peters, Lucas Siemucha, and Josh Silver

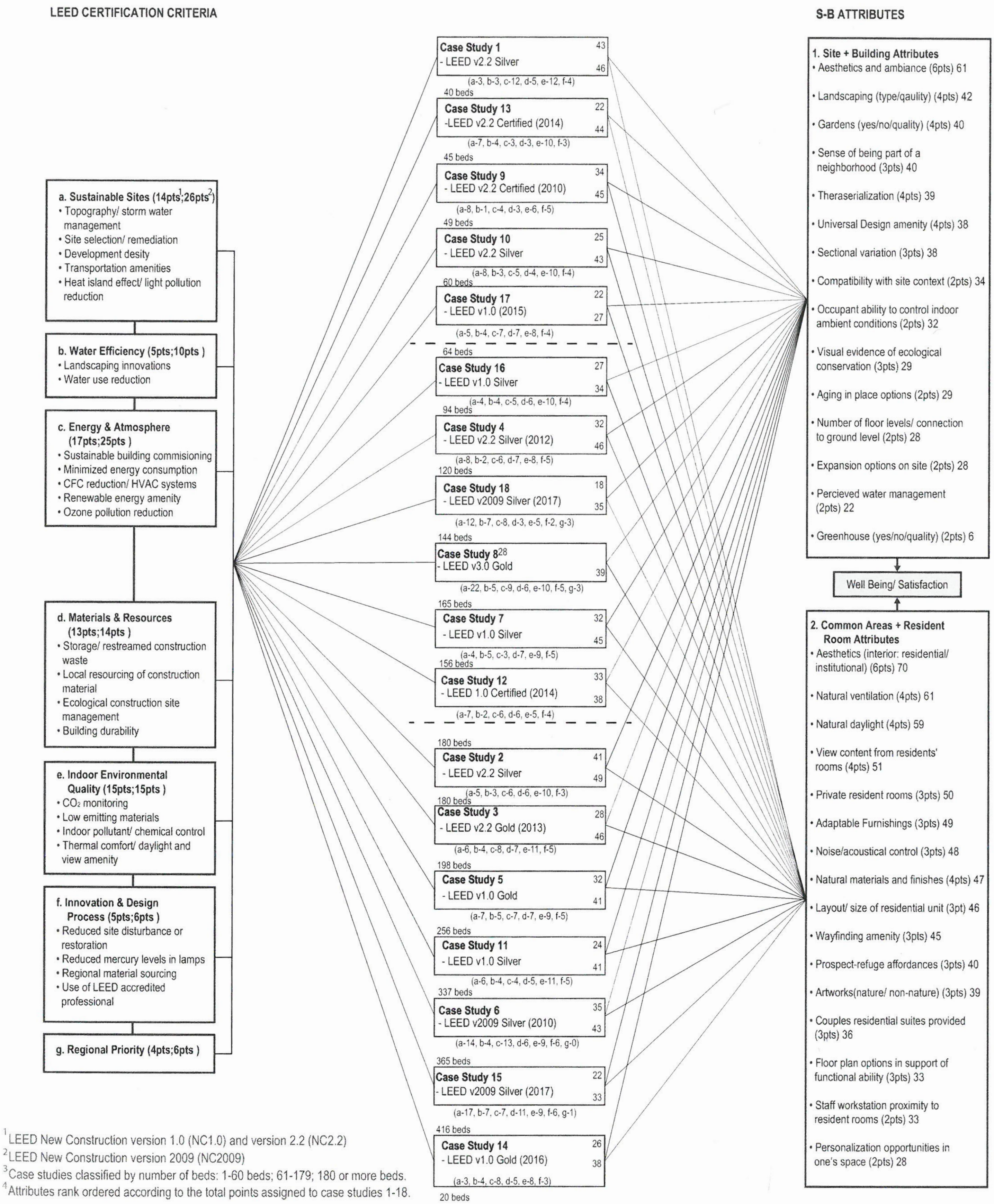
The research aims were operationalized using existing built case studies of LEED-certified long-term care facilities for the aged. The purpose was to study the extent to which these facilities—all LEED certified—express biophilic design attributes. This was done through the analysis of site and floor plans, photographs, LEED documentation on its homepage, and written assessments of each facility as provided by its architects. Eighteen North American, LEED-certified case studies were selected for analysis, based on the USGBC's LEED versions 1.0, 2.2, and NC2009. The case studies were drawn from the professional literature in architecture, design awards programs, online sources, including care provider organizations' homepages, and extensive correspondences with the associated architectural firms. These facilities ranged from urban-suburban to rural in locational contexts, varied from one level to seven levels in height, and were examined via floor plans, photographs, written descriptions, and analysis of their LEED project scorecard. Their various site contexts were also assessed via satellite photo imagery together with at-grade photographs of the exterior site and interior building spaces. The LEED scorecard records total points accrued for the case study, vis-à-vis the seven aforementioned assessment categories, and the level of LEED certification bestowed, whether certified, silver, gold, or platinum. Images and site plan drawings of the six case studies with the highest composite scores are presented in Figure 19.3.

Case studies (CS 1–18) are reported in Figure 19.4, ranked from top to bottom based on the number of licensed beds on-site. Three types of facilities are identified: small to moderate-size facilities (20 to 60 beds), moderate-size facilities (64 to 156 beds), and the large facilities (180 to 416 beds). Next, the points awarded for each of the seven LEED scoring categories are reported (Figure 19.4, center column). Each attribute's maximum awardable points are reported in the far-right column of Figure 19.4 (reported in parentheses). Specific points given to a particular variable were driven by the literature review. The case studies were therefore evaluated relative to 15 site and building attributes, and 16 design qualities focused on residential unit common areas and the resident's room.

A team of five evaluators was assembled to assess and score the set of 18 case studies. This was done in four rating sessions that occurred in late 2017 to early 2018. The panel of assessors consisted of the two authors and three well-versed graduate student research assistants in architecture. Each case study was examined in relation to the 31 biophilic variables, and decisions on how many points to score a given case study resulted in lengthy discussions. Photographs, floor plans, sectional drawings, and in some cases video walk-throughs obtained were projected on a large-format video monitor. These rating sessions were conducted as focus groups, each approximately three hours in length. Ultimately a composite LEED-Biophilic (L-B) score was assigned to each case study. The composite score reflected the total LEED points obtained, divided by the LEED points attainable, plus the biophilic points obtained, and then divided by the total maximum biophilic points attainable, multiplied by 100. To summarize, case studies (CS 1–18) were rated based on the 31 biophilic design attributes, providing a basis for subsequent descriptive statistical analyses.

▲ Figure 19.3

The six case studies with the highest composite scores.
Source: Images courtesy of CC Hodgson Architects Group, GGLO Design, Vigil and Associates, MHG Architects PC, MMMC Architects, and Montgomery Sisam; drawings produced by Stephen Verderber, Terri Peters, and Josh Silver



▲ Figure 19.4

Case studies ranked based on number of beds, facility type and score.

Source: Stephen Verderber, Terri Peters, Oussama El Assir, and Josh Silver

19.5 Results

The ranked composite L-B scores for CS 1–18 are reported in Table 19.1. The four assisted living facilities (including Case Study 17, which also houses an LTC unit on-site) had an average bed count of 113.5 licensed beds. The six freestanding LTC case studies had an average bed count of 262 beds, and the eight LTC aging-in-place campuses had an average bed count of 107 beds. The results are of likely interest to healthcare provider organizations, direct care providers, architects, interior designers, and landscape architects. First, the biophilic attributes associated for CS 1–18 were computed, followed by combining the LEED rating score with the biophilic attribute score for each case study. This step yielded a composite LEED-Biophilic score for each case study, referred to ahead as the L-B score.

19.5.1 The Function of Facility Size

The size of a residential long-term care facility, as categorized according to its total bed capacity, is related to its total L-B composite score. First, midsize facilities (from 60–180 beds) were assigned a lower total composite score (N = 6; mean: X = 67.8) compared to either smaller (N = 5; X = 70.2, from a possible 98 maximum points) or larger facilities. The largest case studies—that is, those with 180 or more beds—were most highly scored (N = 7; X = 71.3). These facilities featured the most amenities and tended to have the most expansive sites. An example includes the Case Study 2 assisted living facility in California (180 beds), with its extensively landscaped grounds and courtyard and variety of "outdoor rooms", varied interior space and room configurations, ceiling heights, and adaptable furnishings. A second example is the Case Study 5 LTC/AIP campus in Ontario, Canada (198 beds). This facility features a large dining room with expansive full-height windows overlooking a landscaped courtyard, and residents' bedrooms have interesting views of nature (nearby woods). It also features a variety of interior spaces that provide direct connections to the outdoors, and natural building materials and finishes are visible throughout the interior.

19.5.2 The Function of Facility Type

When these same data were examined based on the type of LTC facility (Table 19.5), it was found that the LTC/aging-in-place campuses garnered the highest total L-B composite scores (N = 8; X = 73.5), followed by assisted living facilities (N = 4; X = 68.3). The lowest composite scores were assigned to the largest facilities—all freestanding LTC facilities (N = 6; X = 66.5). This finding reinforced the pattern that bigger is not better per se as freestanding LTC facilities were by far largest in terms of their bed capacities. This finding is likely attributable to the fact that aging-in-place campuses tend to provide the most varied spaces and amenities among the facility types included in this study. Furthermore, they tend to provide a range of both indoor and exterior spaces perhaps more closely attuned to the broader range of functional capabilities of their residents. Examples ranged

Table 19.5 Case studies analyzed and scored resulting in a composite LEED-Biophilic score

Case Studies 1–18	Facility Type	Scoring Terminology	a-Sustainable Sites	b-Water Efficiency	c-Energy & Atmosphere	d-Materials & Resources	e-Indoor Environmental Quality	f-Innovation & Design Process	g-Regional Priority	Total Points Awarded + Composite Score
1. LTC/AIP Facility in Michigan	LTC/AIP[1]	L[2]	3(14)	3(5)	12(17)	5(13)	12(15)	4(5)	--	39(70)
LEED v2.2 Silver		B[3](C[4])								89(147)
2. AL Facility in California	AL[5]	L	5(14)	3(5)	6(17)	6(13)	10(15)	3(5)	--	33(69)
LEED v2.2 Silver		B(C)								90(140)
3. LTC/AIP Facility in Nevada	LTC/AIP	L	6(14)	4(5)	8(17)	7(13)	11(15)	5(5)	--	41(69)
LEED v2.2Gold		B(C)								74(135)
4. AL Facility in New York	AL	L	8(14)	2(5)	6(17)	7(13)	8(15)	5(5)	--	36(69)
LEED v2.2 Silver		B(C)								78(132)
5. LTC/AIP Facility in Ontario, Canada	LTC/AIP	L	7(14)	5(5)	7(17)	7(14)	9(15)	5(5)	--	40(70)
LEED v1.0 Gold		B(C)								73(132)
6. LTCF Facility in Ontario, Canada	LTCF[6]	L	14(26)	4(10)	13(35)	6(14)	9(15)	6(6)	0(4)	52(110)
LEED v2009 Silver		B(C)								78(127)
7. LTC/AIP Facility in Ontario, Canada	LTC/AIP	L	5(14)	5(5)	3(17)	7(14)	9(15)	5(5)	--	34(70)
LEED v1.0 Silver		B(C)								77(127)
8. LTC/AIP Facility in Florida	LTC/AIP	L	22(26)	5(10)	9(35)	6(14)	10(15)	5(6)	3(4)	60(110)
LEED v3.0 Gold		B(C)								67(123)
9. LTC/AIP Facility in Maryland	LTC/AIP	L	8(14)	1(5)	4(17)	3(13)	6(15)	5(5)	--	27(69)
LEED v2.2 Certified		B(C)								79(120)
10. LTC/AIP Facility in Maryland	LTC/AIP	L	8(14)	3(5)	5(17)	4(13)	10(15)	4(5)	--	34(69)
LEED v2.2 Silver		B(C)								68(119)
11. LTCF Facility in Ontario, Canada	LTCF	L	6(14)	4(5)	4(17)	5(14)	11(15)	5(5)	--	35(70)
LEED v1.0 Silver		B(C)								65(116)
12. LTCF Facility in Nova Scotia, Canada	LTCF	L	7(14)	2(5)	6(17)	6(14)	5(15)	4(5)	--	30(70)
LEED 1.0 Certified		B(C)								71(115)
13. LTCF Facility in Minnesota	LTCF	L	7(14)	4(5)	3(17)	3(13)	10(15)	3(5)	--	30(69)
LEED v2.2 Certified		B(C)								66(111)
14. LTCF Facility in Ontario, Canada	LTCF	L	3(14)	4(5)	8(17)	5(14)	8(15)	3(5)	--	31(70)
LEED v1.0 Gold		B(C)								64(110)
15. LTCF Facility in New York	LTCF	L	17(27)	7(10)	7(35)	11(14)	9(15)	6(6)	1(4)	58(110)
LEED v2009 Silver		B(C)								55(109)
16. LTC/AIP Facility in Ontario, Canada	LTC/AIP	L	4(14)	4(5)	5(17)	6(14)	10(15)	4(5)	--	33(70)
LEED v1.0 Silver		B(C)								61(109)
17. AL/LTC Facility in Ontario, Canada	AL/LTC[7]	L	5(14)	4(5)	7(17)	7(14)	8(15)	4(5)	--	35(70)
LEED v1.0		B(C)								49(100)
18. AL Facility in Illinois	AL	L	12(27)	7(10)	8(35)	3(14)	5(15)	2(6)	3(4)	40(110)
LEED v1.0 Silver		B(C)								53(90)

1 Long Term Care/Aging in Place Campus
2 Total awarded LEED points by category. Number in paranthases denotes total attainable LEED points
3 Biophillic points (total attained)
4 Composite score [(L points attained divided by L total + B points divided by B total) × 100] with L total points correspoding to that case study's version of LEED and its assessed B points total (in relation to the maximum 98 B points allowed)
5 Assisted Living Facility
6 Long Term Care-Freestanding Facility
7 Assisted Living with LTC unit on sitet

Source: Stephen Verderber, Terri Peters, Oussama El Assir, and Josh Silver

from the Case Study 1, in Michigan (20 beds), to the Case Study 5, in Ontario (198 beds).

This finding, however, invites closer scrutiny particularly with respect to the highest-rated facilities in terms of their composite L-B score. The top rated 50% of the case studies averaged 150.4 beds, which placed them in the midrange in terms of overall facility size, yet this does not mean all that much when viewed more broadly. This is because the top 50% of facilities spanned all three facility types represented—assisted living, freestanding long-term care nursing facilities, and the more comprehensive LTC/aging-in-place campuses. Restated, the quality of biophilic design attributes is more important than the sheer physical size of a facility—that is, a facility's architectural design quality takes precedence over the amount of space provided per se.

A second pattern revealed concerned the relative usefulness of the biophilic design attributes as individual metrics in rating healthcare facilities for the aged. These items were rank-ordered (Figure 19.4, far-right column) in terms of the total number of points assigned to each item: items 1–15 for site and building attributes, and items 16–31 for the common areas and resident bedroom attributes. This ranking reflected the cumulative score assigned to each of the 18 case studies.

19.6 Toward the Establishment of an Inclusive Rating System

As for the research methods used in this pilot investigation, it would have been preferable to conduct on-site post-occupancy evaluations at each of the 18 case study sites. However, funds to do this were unavailable at the time. In the future, this step is recommended as there is no substitute for direct observation versus a reliance on correspondence and archival data sources, such as drawings, photographs, and Skype interviews with the architects and firms that worked on the 18 case studies. For these reasons, while this study provides a useful introduction to the core issues, and a platform for further research and applications to professional practice, it is best appreciated as a pilot study. With that said, the following minimum recommendations are hereby put forth in order to create a more inclusive points-based rating system that embraces ecological and sustainability concerns with biophilic design patterns and principles:

For the USGBC:

1. Establish an internally consistent LEED rating system: First and foremost, if LEED is to remain a leading source of "green" certification, the rating system is in need of streamlining. All project profiles in the USGBC homepage database need to include site plans, photographs, client, design team information, and project narratives. A single, unified points rating system is needed for healthcare. For example, current LEED versions BD+C, LEED Interiors, LEED Existing Buildings, LEED Homes are all being used to evaluate 24/7 residential care environments for the aged. Inconsistencies between these various versions remain problematic. As an example, a project certified under LEED BD+C New Construction v2.2 can earn a maximum of 69 points. By contrast, another of the 18 case studies was rated using LEED BD+C New Construction version 2009 and its score

totaled 110. Case study 18's score was 40/110, thereby meeting LEED v1.0 Silver certification status.

2. Create interdisciplinary partnerships and a more inclusive rating system: After this internal standardization process has been completed, next, the USGBC should seek out collaborative partnerships with organizations that actively promote the topic of biophilic and salutogenic research and its applications in professional design practice. The USGBC has become, in this respect, rather complacent. While many organizational improvements have been made over the past 19 years, it is time for a thorough internal reassessment—one that bridges its core mission with salutogenic and biophilic design patterns/principles. This will itself fuel further innovations in the future, including joint conferences, awards programs, and interdisciplinary journals.

For the environmental design research community:

3. Lobby to integrate biophilic design in professional practice: Healthcare provider organizations need to place high value on the development of widely recognized best practices in ecological and life-affirming design. One way to achieve this is through a single, unified, more inclusive LEED rating system. The integration of these two currently independent knowledge bases provides a unified platform for significantly higher-quality 24/7 healthcare built environments than at present. Unfortunately, the current LEED program remains lacking in this regard (Fitzgerald and Spaccarotella 2009). Similarly, the concept of "total facility performance" is in urgent need of redefinition (Peters 2017).
4. Establish an equivalent professional organization to collaborate with the USGBC: At present there is no clear-cut "point organization" specifically devoted to biophilic research and design activities nor any professional organization with this as its specific charge. This area of research and its applications to professional practice currently most closely rest within the broad manifold of concerns addressed by the EDRA.

For architects and allied design and planning professionals:

5. Establish ecohumanist, evidence-based organizational policies: Promote the establishment of new research opportunities—that is, grants, internships, and fellowships—in order to generate new ecohumanist knowledge in the planning, design, and daily operation of care settings. Similarly, any such evidence-based design awards programs should recognize and honor ecological sustainability as equal in merit with other metrics used in evaluation (Verderber et al. 2014; Peters and Verderber 2017).
6. Work with clients to broaden their vision of design excellence: At present LEED is viewed in North America by most healthcare provider clients as the preeminent gold standard for architectural sustainability, yet this investigation has shown it is noticeably lacking in terms of its autonomy from the experiential, everyday aspects of built environments for healthcare. The LEED rating system, however, continues to be presented to client organizations by their architects as the most respected vehicle for a client organization to proclaim its ecological "greenness" and present itself as a bona fide environmental steward in its local community.

19.7 Conclusions

Eighteen LEED-certified 24/7 residential care environments for the aged were examined for their ecological and energy conservation merits in direct relation to their biophilic design affordances. The highest composite-scored case studies were found to express what might be defined as an "ecohumanist" design perspective—an aesthetic vocabulary expressing ecological principles together with a significant degree of person-nature connectivity (Verderber 2010). A facility's size, as measured by the number of licensed beds and type of facility, was found to have an impact on the presence (or absence) of such biophilic design attributes in 24/7 long-term care residential settings for the aged.

Healthcare provider organizations and their architects, interior designers, and landscape architects are ideal advocates to promote research that promotes environmental design excellence (Moffat 2006). Innovative thinking, combined with coordinated advocacy efforts, will result in greater inclusivity. Architects can lead the way as advocates in this regard for a rating system that unifies ecological sustainability with person-nature patterns and principles. In light of these findings, a single rating system fusing the current LEED system with biophilic design affordance appears to be warranted.

Non-convergence—or what more aptly might be defined as mutual exclusivity—continues to prevail between the sustainable healthcare design and biophilic design movements. This investigation has been the first to systematically compare the LEED certification system in direct relation to the expression of biophilic design attributes in architecture for health. The overarching finding was that LEED certification in and of itself neither guarantees nor predicts a high level of ecohumanist architectural design excellence. It is the client's and designer's responsibility, therefore, to recognize that rating systems should never distract from the end goal—total user wellness and satisfaction.

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