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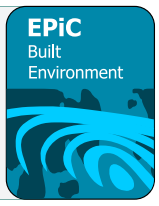

A Data-Driven Study of Regional Priority Credits and Their Impact on LEED Certification in Multifamily Residential Projects

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This study investigates the influence of Regional Priority (RP) credits on LEED certification outcomes for multifamily residential projects under the LEED for New Construction (LEED NC) Version 3 framework. Leveraging data from 878 certified projects, the analysis explored the frequency, distribution, and predictive power of RP credits on overall LEED scores. Sustainable Sites credits emerged as the most frequently achieved category, reflecting their critical role in addressing urban environmental challenges such as stormwater management and heat island mitigation. Geographic analysis revealed regional clusters of RP credit achievements, with the East Coast, West Coast, and Great Lakes regions leading in adoption, likely driven by local environmental priorities and policy frameworks. A linear regression model demonstrated a significant positive association between the number of RP credits earned and overall LEED scores, with each additional RP credit contributing approximately 2.42 points. These findings highlight the strategic importance of RP credits in enhancing LEED certification outcomes, particularly in urban and high-density settings, where tailored sustainability practices are essential. This study underscores the value of regionally relevant credit strategies in advancing green building performance and provides actionable insights for optimizing certification pathways in multifamily residential developments. Future research should examine the interplay of climate, project size, and regional policies to refine RP credit frameworks further and maximize their impact on sustainable construction.

Key Words: LEED, Regional Priority, Multifamily Residential Buildings, Sustainability.

Introduction

Sustainability is more than just a concept now, and green design and construction are now seen as key components of the world's development. Green building systems such as Leadership in Energy and Environmental Design (LEED) are increasingly popular across the world, encouraging sustainable design and construction. The United States Green Building Council (USGBC) created the LEED certification, a globally known green building certification system that assesses building environmental performance and encourages the market to switch toward sustainable design and construction. LEED accreditation focuses on various areas of sustainability, including the use of energy, water efficiency, indoor environmental quality, resource efficiency, and sustainable site development, among others. One of the most significant of those factors is the Regional Priority (RP) credit, which assesses a specific location's environmental concerns. RP credits identify projects that address location-related problems,

making them an important factor in achieving higher LEED certification levels. These credits seek to make LEED certification more relevant to a project's location by addressing the most significant environmental challenges in a specific area (Wu et al., 2016).

Designers and developers should make informed decisions about which credits to prioritize in order to optimize both sustainable outcomes and certification levels when seeking LEED certification. LEED certifications range from Certified to Platinum, reflecting commitment to various levels of environmental responsibility and resource efficiency. RP credits stand out in this framework because they allow projects to not only achieve basic sustainability standards but also address concerns that are particularly important in their geographical area. For example, a project in a desert location may focus on water conservation, whereas one in a dense urban context may focus on transportation efficiency and decreasing the urban heat island effect (Wu et al., 2018).

The growing demand for multifamily housing in many locations needs reconsideration of how sustainable practices work in this sector (Goodarzi & Garshasby, 2024). As urban populations increase, developers are under pressure to build additional housing, typically in places that already struggle with pollution, water shortages, and transportation problems. The implementation of RP credits can help address these difficulties by encouraging developers to use methods that are specific to their location. Green building certification techniques such as LEED might vary in effectiveness depending on local climate and conditions (Goodarzi et al., 2023). This indicates that locally adapted techniques are necessary for essential sustainability outcomes. (Mattoni et al. 2018).

While RP credits play an important role in achieving LEED certification, their true impact, particularly for multifamily residential buildings, has remained unclear. This is important as high-density multifamily residential projects are increasing in cities where sustainability is a concern (Goodarzi & Berghorn, 2024; Jalaei et al., 2020). Multifamily buildings often face particular issues relating to energy efficiency, water conservation, and indoor environmental quality, all of which are important parts of LEED certification (Amiri, Ottelin, and Sorvari 2019; Luo, Scofield, and Qiu 2021). These projects often have specific sustainability requirements and face challenges that single-family or commercial buildings may not (Goodarzi & Berghorn, 2025). For example, multifamily buildings consume a large amount of water and energy because of the high density of residents, which makes water and energy efficiency important (Luo, Scofield, and Qiu 2021; Tushar et al. 2021). Many of the challenges of multifamily residential projects are either directly or indirectly related to the location and geographical region of the projects. This highlights the role of regional factors in determining the sustainability of these projects. Therefore, by exploring the relationship between RP credits and LEED certification levels, this study helps the continuing discussion about the role of location-related factors in achieving LEED certification for multifamily developments. This study uses data from 871 certified projects to identify relationships between RP credit achievement and total LEED scores.

Literature Review

The popularity of the LEED study emphasizes its global importance and effect on environmentally friendly building methods. According to Lei and Cui (2022), over the last few years, there has been a significant increase in research analyzing LEED's performance and application in various countries and project types. They explored trends in LEED-related publications and found that there is considerable interest in how LEED may better respond to local environmental concerns using RP credits. Their research reveals that, while LEED is beneficial in general, its regional adaptation through credits such as RP needs further investigation and standardization.

Further expanding on the adaptability of LEED, Wu et al. (2016) explored how different projects around the world earned credit under LEED Version 2.2 and found the importance of location in credit achievement. Projects usually prioritize credits for water and energy efficiency as the United States emphasizes resource conservation, but in highly polluted areas, projects are more likely to prioritize credits for air quality and waste management. The study showed how LEED's flexibility enables green building, but it also identified areas where standardization may improve LEED's value in a variety of conditions. Wu et al. (2016) findings suggest that more comprehensive guidelines on RP credits might help projects better address specific area concerns while maintaining LEED's core sustainability principles.

LEED v4, the most recent version of the certification, offered stricter requirements for RP credits that address regional environmental objectives. According to Pham et al. (2020), LEED v4 encourages the construction team to choose credits that help not only the building's immediate environment but also the community's overall sustainability goals. According to their findings, projects using LEED v4 are more likely to include credits that address important issues such as local climate adaptation, sustainable materials, and energy perseverance. Their research highlights that while LEED v4's RP credits have the potential to encourage more localized and meaningful sustainable practices, they also need a greater understanding of area environmental issues, which can often be an obstacle. Sadikoglu, Demirkesen, and Zhang (2022) findings show credits in Sustainable Sites (SS) and Water Efficiency (WE) consistently predicted higher LEED outcomes. It is specifically relevant for multifamily residential projects, where sustainable site planning and efficient water use are important due to the potential impacts on residents and communities. This is similar to Pushkar and Verbitsky (2018) finding. They found that RP credits addressing resource conservation and environmental quality have a statistically important influence on achieving higher certification levels, which shows the value of selecting RP credits that align with regional priorities.

Waldman (2022) highlighted the rising importance of prefabrication in earning LEED credits. Prefabrication techniques can improve a project's sustainability by reducing waste and enhancing quality control. All of which are consistent with LEED's emphasis on resource efficiency and waste reduction. Their findings suggested that prefabrication is especially beneficial for achieving RP credits as it allows for better use of materials and efficient building procedures, which are especially useful in locations with limited resources or specific environmental issues. Therefore, project teams may improve their LEED certification outcomes and earn more RP points by employing prefabricated products that match area environmental issues.

Method

This study examines the relationship between RP credits and overall LEED certification outcomes for multifamily residential projects. Data was sourced from the United States Green Building Council's (USGBC) LEED Project Directory, focusing on projects certified under the LEED for Building Design and Construction for New Construction and Major Renovation (LEED NC) Version 3 (v2009).

Data Collection

A total of 899 projects certified by October 2024 were initially identified and screened for inclusion. After excluding 21 projects due to incomplete information, a final dataset of 878 projects was compiled. The dataset included detailed project information such as certification levels, certification dates, locations (states and cities), project types, and scorecards. The scorecards provided data on the total LEED points achieved and the specific RP credits earned by each project.

Data Analysis

The analysis was conducted in three main stages:

Descriptive Analysis: The frequency of achieved RP credits was calculated to identify the most earned credits across different LEED categories. These results were visualized using a word cloud to highlight patterns in RP credit achievement. Additionally, the geographic distribution of RP credits was mapped using ArcGIS, with larger circles representing projects achieving a higher number of RP credits.

Visualization and Results Presentation: To illustrate findings, multiple visual and tabular representations were employed, including tables summarizing the frequency of RP credits by category and individual credit type, a word cloud to visualize the most frequently achieved credits, and geographic maps displaying the spatial distribution of RP credit achievements across states.

Regression Analysis: To evaluate the predictive power of RP credits on LEED certification outcomes, a linear regression model was developed. The dependent variable was the total LEED score (ranging from 40 to 110), and the independent variable was the number of RP credits achieved by each project (ranging from 0 to 4). The model included two components: a baseline model (M_0) and a model incorporating RP credits (M_1). Key regression metrics, including R^2, standardized coefficients, and ANOVA results, were reported to assess the strength and significance of the relationship.

This methodical approach enabled a comprehensive evaluation of the impact of RP credits on LEED certification, providing insights into their role in advancing regionally targeted sustainability practices.

Results

Frequency and Distribution of RP Credits

The study identified a total of 1,659 RP credits achieved across all projects, with the Sustainable Sites (SS) credit category accounting for the majority (n = 1,214, 73.2%), followed by Materials and Resources (MR; n = 157, 9.5%), Water Efficiency (WE; n = 151, 9.1%), Energy and Atmosphere (EA; n = 104, 6.3%), and Indoor Environmental Quality (EQ; n = 33, 2.0%). Within these categories, the most frequently achieved RP credits included SSc6.1 (Stormwater Management, Quality Control; n = 250), SSc4.1 (Alternative Transportation, Public Transportation Access; n = 159), and SSc7.2 (Heat Island Reduction, Roof; n = 134), reflecting a strong emphasis on site-specific interventions such as stormwater management and urban heat island mitigation (Table 1, Table 2, Figure 1).

Table 1. Number of achieved RP credits by credit category

LEED Credit Category	**Number of RP Credits**
SS	1214
WE	151
EA	104
MR	157
EQ	33
Total	1659

Table 2. RP credit and the number of times each was achieved

PR Credit	N	RP Credit	N
Ssc6.1	250	Eac1	36
Ssc4.1	159	Ssc4.4	35
Ssc7.2	134	Mrc1.1	26
Ssc5.2	123	Ssc1	26
Ssc3	111	Wec1	26
Wec3	109	Ssc4.3	17
Ssc5.1	101	Wec2	16
Mrc2	88	Eqc7.1	16
Ssc2	88	Eqc8.1	15
Eac2	67	Mrc7	2
Ssc7.1	67	Eqc2	1
Ssc4.2	56	Eac5	1
Ssc6.2	47	Eqc6.1	1
Mrc5	41		
Total		1659	

Figure 1. Word cloud showing the frequency of the achieved RP credits

Geographic Distribution of RP Credits

The geographic analysis demonstrated that RP credit achievement was concentrated in the East Coast, West Coast, and Great Lakes regions (Figure 2).

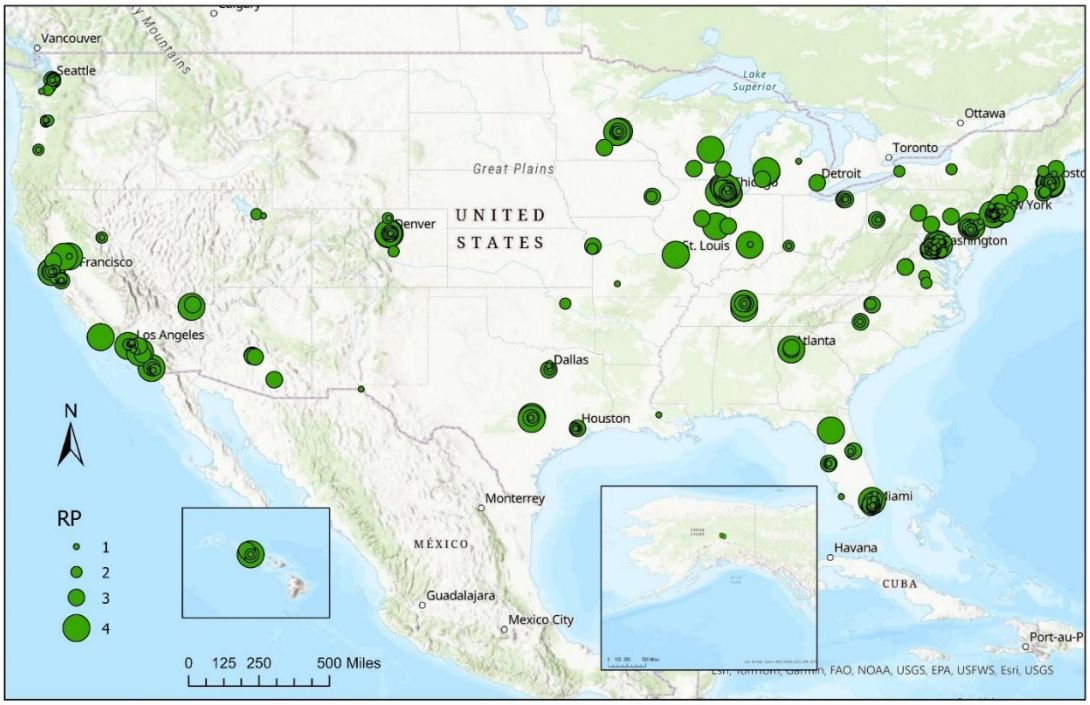

Figure 2. The distribution of the number of RP credits achieved across the United States

As can be seen in Figures 2 and 3, The District of Columbia (DC) led with the highest number of RP credits achieved (n = 99), followed by Illinois (n = 88), California (n = 78), New York (n = 77), and Maryland (n = 69) (Figure 3). These clusters suggest that urbanized states with stringent environmental policies or active green building initiatives prioritize regionally relevant sustainability measures.

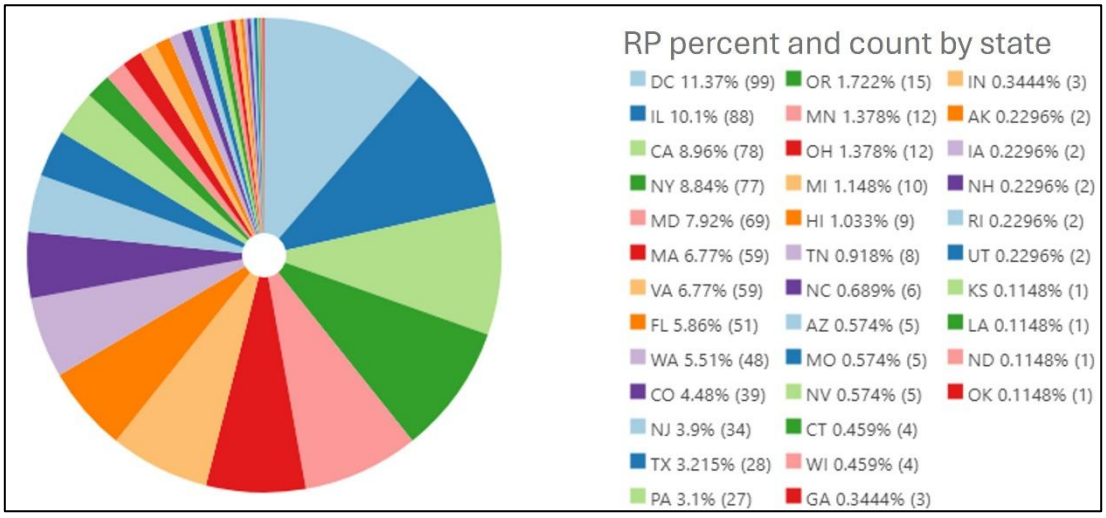

Figure 3. RP credits numbers and percentage of total for each state

A linear regression model assessed the relationship between the number of RP credits achieved and the overall LEED scores. The inclusion of RP credits (M_1) significantly improved the model's predictive power compared to the baseline (M_0). The R^2 for the model, including RP credits, was 0.145, indicating that 14.5% of the variability in LEED scores was explained by RP credit achievement (Table 3).

Table 3. Regression Model Summary

Model	R	R^2	Adj. R^2	RMSE	Autocorrelation	Durbin-Watson Statistic	p
M_0	0	0	0	7.88	0.095	1.804	0.004
M_1	0.381	0.145	0.144	7.29	0.08	1.835	0.015

Note. M_1 includes RP

The standardized coefficient ($\beta = 0.381$, $p < .001$) confirmed a positive and significant association, with each additional RP credit contributing approximately 2.42 points to the overall LEED score (Table 4).

Table 4. Coefficients

Model		Unstandardized	Std. Error	Std.	t	p
M_0	(Intercept)	53.884	0.267		201.782	< .001
M_1	(Intercept)	49.268	0.453		108.681	< .001
	RP	2.416	0.199	0.381	12.144	< .001

These findings were supported by the ANOVA results, which showed a significant improvement in model fit with the inclusion of RP credits ($F = 147.483$, $p < .001$; Table 5).

Table 5. ANOVA

Model		Sum of Squares	df	Mean Square	F	p
M_1	Regression	7840.37	1	7840.37	147.483	< .001
	Residual	46196.918	869	53.161		
	Total	54037.288	870			

Note. M_1 includes RP

Note. The intercept model is omitted as no meaningful information can be shown.

Discussion

The findings of this study underscore the critical role that Regional Priority (RP) credits play in influencing LEED certification outcomes, particularly within multifamily residential buildings. The significant correlation between the attainment of RP credits and overall LEED scores highlights the potential for these credits to enhance sustainability efforts strategically while addressing location-specific environmental challenges.

The predominance of Sustainable Sites (SS) credits among RP achievements, as observed in this study, reflects a widespread focus on site-specific environmental strategies. This aligns with the findings by Sadikoglu et al. (2022), who emphasized the importance of site planning in achieving higher certification levels. The high frequency of SS credits suggests that developers prioritize interventions

such as heat island reduction and transportation efficiency, which are often critical in urban multifamily settings. This prioritization resonates with the findings of Wu et al. (2016), who noted regional disparities in credit preferences, with urban areas typically emphasizing transportation and site management to mitigate density-related challenges.

Despite the relatively lower frequency of Water Efficiency (WE), Energy and Atmosphere (EA), and Indoor Environmental Quality (EQ) credits, their inclusion still provides meaningful contributions to overall sustainability. The positive and significant predictive relationship between RP credits and LEED scores (standardized coefficient = 0.381, $p < .001$) suggests that even a modest increase in RP credits can substantially influence certification outcomes. This finding corroborates the work of Pham et al. (2020), who highlighted the integrative potential of LEED v4's RP framework in advancing localized sustainability goals.

The geographical concentration of RP credits along the East Coast, West Coast, and Great Lakes regions indicates potential disparities in regional engagement with LEED. Factors such as stricter state-level sustainability policies or higher demand for green-certified housing may contribute to these clusters. This observation aligns with Lei and Cui (2022), who noted regional variability in LEED adoption, often driven by local environmental and regulatory pressures.

Interestingly, the study reveals that RP credits contribute to approximately 14% of the variability in LEED scores. While this effect size is moderate, it is consistent with the multifaceted nature of LEED certification, where multiple factors contribute to the overall score. It also reinforces the assertion by Mattoni et al. (2018) that localized strategies, while impactful, operate within a broader framework of interconnected sustainability criteria. Further refinement in RP credit frameworks, perhaps through targeted guidelines for multifamily developments, could amplify their contribution to certification outcomes.

Moreover, the significant role of Sustainable Sites and Water Efficiency credits aligns with Luo et al. (2021) and Tushar et al. (2021), who emphasized the importance of resource conservation in high-density residential settings. Multifamily projects often face unique challenges related to resource consumption, and RP credits addressing these issues provide an opportunity for tailored impactful interventions. Incorporating building performance monitoring could further enhance these outcomes by ensuring sustained operational efficiency post-certification.

Conclusion

The findings of this study emphasize the need for greater emphasis on RP credits in the LEED certification strategy for multifamily residential projects. Policymakers and project developers should consider these credits as a means to enhance regional relevance and sustainability impact. Additionally, advancing tools for visualizing and monitoring RP credit achievements, such as those employed in this study, could inform better decision-making during project planning and execution.

The study emphasizes the importance of RP credits in LEED certification while recognizing the need for further investigation into the influence of local policies, financial incentives, and industry practices on RP credit achievement across regions. Additionally, the study identifies water and energy efficiency credits but has not analyzed the role of resident engagement in maximizing these credits' effectiveness in multifamily buildings. Future research should incorporate resident behavior metrics to better assess RP credit impact. Furthermore, while geographic patterns of RP credits were mapped, the role of regional climate conditions and policy frameworks in driving credit adoption remains unexplored.

Addressing these elements in future studies could enhance the understanding of RP credit distribution and sustainability outcomes. Climate factors could reveal how environmental conditions influence the prioritization of certain RP credits. Project size is another factor that could be considered in future investigations on RP credits as it can highlight scalability challenges in implementing sustainability strategies. Additionally, analyzing location-specific variables, such as urban density or regional policy frameworks, could shed light on the broader contextual factors that shape credit achievement patterns and their impact on certification outcomes. This approach would enable a more tailored and comprehensive evaluation of RP credits' effectiveness in driving sustainable development.

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